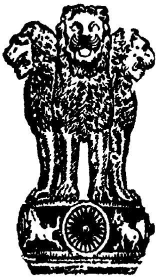

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# MAKING ROADS TO NOWHERE

A. G. Street

*Author of " Farmer's Glory," " Strawberry Roan," " The Endless Furrow," etc.*

In common with the majority of farmers, whilst I regretted the loss of my individuality, I voted for the establishment of the existing marketing schemes, simply and solely because I realised that the time had come when I could no longer make my farming pay by fighting world economic conditions as an individual. Now that this policy of " planning " has been in operation for a full year with regard to many farming products, I have been considering whether it can be fairly described as being either a success or a failure.

Naturally I have plenty of private grouses. For instance, my brother, who farms in Hampshire, has been getting about one penny per gallon more for his milk than I, who farm in Wiltshire, and, quite honestly, I don't see why he should. Many of my neighbours, who, prior to the scheme, had been in possession of an advantageous individual market in some near-by town, tell me that they have suffered very hardly indeed under the new regime. And they don't just murmur their complaints—" They say so very loud and clear, and some have shouted in my ear." Even so, I am conscious that, but for the English Milk Marketing Scheme, both my disgruntled neighbours and myself would be obtaining several pence less per gallon for our milk than the present price which we do obtain.

However, in this article I want to forget both the individual hardships and benefits due to the present marketing schemes, and try to take a broader view of the whole policy of a " planned " agriculture, especially with regard to the future. Quite frankly, I am not surprised at the mistakes which some of the Marketing Boards have made; rather am I amazed that they have made so few mistakes. Few people outside the farming industry, and too few of those inside it, have any conception of the size and daring of this experiment of " planning " in connection with live-stock farming. To my mind it is the first time in the history of farming politics that any administration has even recognised that live-stock comprises nearly three-quarters of our farming. Hitherto, when anyone has wanted to impress his audience with his knowledge of farming's needs, he has said, "What we want, ladies and gentlemen, is a balanced agriculture." Then he has spread his hands apart and waggled them up and down in imitation of a pair of scales, and everybody in his audience has applauded vigorously. But, almost invariably, this speaker has been too wily to pursue this subject any further, and state on what he proposed to balance our farming; and when farming legislation has come before him he has always voted to balance it upon wheat.

Surely that was a very narrow thing on which to build a successful farming industry! Wheat is a useful crop, a very useful crop if you like, but to-day it is but a bare 3 per cent of British agriculture, while live-stock comprises 72 per cent. An agriculture balanced upon 3 per cent must be an unstable top-heavy structure, but, if it be balanced on the broad basis of a prosperous 72 per cent, it would be both possible and practicable to hang little things like wheat anywhere on it without endangering its stability in the slightest degree. Now, at long last, we have an administration which appears, not only to recognise this fundamental truth, but also to show active concern for our live-stock industry, and this marks a great step forward in agricultural policy.

From the moment our rulers began to consider the live-stock side of our farming, its enormous size by comparison with any other branch of the industry became evident; so much so that, apparently, straightforward tariffs or subsidies, possible remedies for the smaller branches of farming, were out of the question. Accordingly, they decided to try to find out the details of this vast business, and to do so they inaugurated the present policy of "planning" and "controlled marketing." As a result much valuable information has come to light, and some improvements in the quality of the produce have been effected. For instance, from the first year's working of the English Milk Marketing Board it was discovered that 73 per cent of the total milk handled was sold for "liquid" consumption, and that 27 per cent went into manufacture. Prior to this no one knew these exact proportions. Again, in the newspaper reports of the recent Smithfield Show the following passage pays a very high compliment indeed to the Pig Marketing Board:—

> "All through the pig section there is evidence that breeders are influenced by the demands of the marketing scheme. As types the animals do not as a whole reflect breed standards so much as the economic standards laid down for bacon pigs."

One hesitates to describe the Pig Board as a "David," but, until "controlled marketing" came into being, the hide-bound policy of many of our breed societies of all classes of live-stock was a veritable "Goliath" of delay in agricultural progress. Both producers and consumers of bacon should take their hats off to the

Pig Board for being the first to tackle this monster, and thereby publicly to admit that cardinal truth, " the palate beats patriotism every time."

On these two points of obtaining reliable information concerning our live-stock industry and of effecting a definite improvement in the quality of its products I consider that the present marketing schemes have been amply justified, but with regard to the future of them and of the prosperity of the branches of farming which they control I am very worried. No matter where I go or what marketing scheme I investigate I come across the hint, and sometimes more than the hint, of restriction of production. Scottish farmers tell me that their potato farms have now a fixed quota of acreage, and that for every acre which a farmer decides to put into potatoes beyond this quota he has to pay £5 to the Potato Board. Presumably then, this quota of acreage must be a saleable article, and anyone selling it would receive money for *not* growing potatoes. Again, the wheat quota appears to be arranged to guarantee a certain price for not more than a certain quantity of wheat. Whenever and wherever I attend an N.F.U. meeting or dinner the same hint of the need for restriction of production with regard to milk is in evidence. Again and again I am told, owing to the recent increased milk production in the West of England, that the pool price has had to be reduced, and I understand that the same trouble has been experienced north of the Tweed.

From the point of view of those people who are responsible for the running of the present marketing schemes it is easy to see the reason for these hints of the need for future restriction, and also for the existing rules of restriction of production. Whilst our farming policy remains in its present form these are inevitable, as in every case further increased home production will mean a reduction in price, a reduction which will mean not only the failure of the schemes affected and the whole policy of " planning," but also the collapse of our home farming industry.

Therefore, I think that the time is more than ripe for a further step forward in the " planning " of our home farming. The whole purpose of farming is for a man to try to be a better farmer each succeeding year ; in other words to try to produce more from his farm next year than he did this year. Once a farmer is told to produce 90 per cent only of his last season's output, the whole business of farming becomes absurd. For instance, if it comes about that a farmer is to be paid for not producing a certain weight of potatoes per annum, we shall have farmers writing to the Ministry or Department of Agriculture asking which is the best sort of potato not to grow. In farming the principle of restriction of production *must* be wrong, more especially in a small thickly-populated island such as Britain ; and when the principle of a policy is wrong, its details cannot work out successfully, no matter how ingenious they may be.

The trouble seems to be that the productive branches of world civilisation are away ahead of the administrative side—we have found out how to produce a plenteous supply of commodities, but we don't know how to distribute them. For many years now the policy of society all over the world has been to pay the producer a decent salary for his services, only while he has remained an inefficient servant and produced less than society required; and to reduce his salary to starvation point immediately he became efficient and produced a plenteous supply of goods. I recognise that modern transport and communication have made the world a much smaller place; I am aware that this country cannot carry on in splendid isolation from other countries, and especially from the British Empire, with regard to mutual trading in each other's products; and I have no doubt that some day in the future man will discover how to deal adequately and fairly with both producer and consumer with regard to the wealth of commodities which modern science and invention have made available for his use. But surely, even before that happy state of common sense arrives, there can be no need for restriction of production in *every* branch of our home farming.

Here is a small island, so small in comparison with its population that it cannot produce all its food requirements under any regime. Therefore the British nation *must* import a certain proportion of its food. Even so, while restriction of home production in certain products may be advisable, there must be *some* products of our home farming which in the national interest our farmers should produce to the maximum capacity of land they farm, even while fullest consideration is given to international and Empire trading. In other words the next step in the policy of " planning " must be for our rulers to make a choice of the products of our home farming which are to be restricted to a certain quantity, and also of those commodities in the production of which our farmers are to go full speed ahead.

Unless this choice is made the present policy of controlled marketing is merely making roads to nowhere,—the fact that the roads may be well made is useless unless they are being made to a definite end. The farmers of this country have sunk their individuality for the common good as well as in the hope that by so doing they might prosper a trifle better. They have submitted to this " planning " policy, and they are entitled to know to what end our administrators are planning our home farming. The marketing schemes cannot achieve their full usefulness to the farming industry or to the nation unless fuller and more explicit information is given to the men who are running their businesses under their rule.

For instance, up to date the milk marketing scheme in England has no definite policy, but has been primarily, almost entirely, concerned with keeping the accounts of the milk producers. Until someone in authority says definitely that *more* milk is wanted or that *less* milk is wanted the present road for our milk is a road to nowhere ; and until that statement is made one way or the other the efforts of the Milk Marketing Board will achieve very little improvement in the dairying side of our farming. How can they do so ? Supposing the Board manages to arrange, not a very attractive price for milk, but merely a price at which the dairy farmer can see a certain small profit, the inevitable result will be an increase in the volume of milk, and a subsequent calamitous fall in milk prices.

At present the " liquid " milk has to subsidise the " manufacturing " milk, and any increase in milk production means a lower price all round. Yet we import twice our annual production of milk in the form of manufactured milk products. If our dairy farmers were told definitely that the nation wanted more milk, and also that a living wage would be paid to those who produced it, they could double their production. This of course, would mean a reduction of imported milk products with a corresponding rise in their price. On that ground the consumer might object, but, in effect, this might easily lead to still lower prices for liquid milk, even though prices for butter, cheese, etc. would be higher. It might even bring about a state of things when milk for any purpose was worth the same price, and from an administrative standpoint this would be invaluable.

I have taken milk as an illustration because I am most familiar with that side of farming, but the necessity for a clear statement of future policy is urgent with regard to all farm products which are now in the hands of Marketing Boards. A farming life is ridiculous unless it permits a farmer, or rather urges a farmer, to produce to his utmost, and it is high time that British farmers were told frankly which products to increase and possibly which to decrease. To make this choice would most certainly be unpopular with many people, but never was there a time when the need was more urgent for those in authority to take the risk of becoming unpopular. My own view is that any increase in home production should be devoted almost entirely to the perishable products, in which the home farmer can beat the overseas farmer for quality—to state them briefly, meat, milk, eggs, and fresh market-garden produce. However, which products are chosen for an increase in home production is comparatively immaterial ; but that *some* products of our farming should be chosen for this purpose is an urgent need, not only for the farming industry but for the whole nation.

I included the words " the whole nation " in that last sentence because just now there is a lot of talk about land settlement and getting the unemployed on to the land of this country. The Commissioners for the Derelict Areas are told on all sides that we have idle men and idle acres and that these idlers must be brought together for the common good. At first sight to do this seems both easy and practicable, but on closer examination one finds two grave difficulties. Firstly, what is the good of putting more people on the land before a state of things has been achieved when those already on it can make a decent livelihood ? Secondly, how can any more people be put to work on the land of this country without a resultant increase of production from that land and their labour ?

Even if the first question be considered of small importance, the second cannot be dismissed. It will be nothing short of criminal to settle unemployed men from other trades on the land, without first obtaining definite assurance from those in authority that in certain directions an increase in production is desired, and that the men who bring it about will obtain a decent livelihood. Not only will their last state be worse than their first, but, in addition, their efforts on the land will bring about a still lower standard of living for all those who are already engaged in farming.

As a nation we possess the most beautiful countryside in all the world. It is also one of the best, if not the best countryside for farming. Our farmers are its trustees, and much of its beauty as well as its usefulness is due to the charming patchwork pattern with which their operations clothe it year after year. We cannot destroy it and we cannot afford to neglect it. Let us rather try to use it in the best way for the common good. Despite the present abundance of commodities in the world there must be *some* products of our home farming which we need in greater supply. Is it too much to ask our rulers to tell the British farmer in which branches of farming he can use his brains, his brawn, his capital and his land, to their fullest possible capacity, and so make it practicable to find a decent life on the land for many of our unemployed people ? Until this is done the present marketing schemes will be merely making roads to nowhere, and, in my opinion, roads on which there can be no room for the unemployed to travel.

# BETTER LIVING: THE COMMUNITY MOVEMENT IN THE COUNTRYSIDE[1]

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JUST over thirty years ago two men met at Oyster Bay, Long Island. One was Theodore Roosevelt who had succeeded to the Presidency of the United States, the other was Horace Plunkett, then Vice-President of the Department of Agriculture and Technical Instruction for Ireland, who had come to see his old friend of cowboy days and wish him well in his new office. Roosevelt told Plunkett of his ideas for a rural life policy in the United States, and then said to him, " Horace, give me a slogan." The response came

[1] A paper read at the British Association Meeting at Aberdeen, September 1934.

quick—" Better farming, better business, better living." " Bully," said the President, " I shall megaphone that all over the country." That was the baptism, if not the birth, of the Country Life policy of the Three Betters. It was Horace Plunkett's philosophy of rural life. For thirty years he preached it tirelessly, and steadily it has been gaining wider and wider acceptance. In some ways the world of to-day may seem to have passed by Plunkett's teaching on the other side, but, if I may venture to prophesy, it will come back to his saner view of life. For his personality and his thought have attracted, and will continue to attract, the attention of men and women widely scattered over the world. It almost seems as if the prophet had had more honour in the East and the West than in his own country. In the United States and in Canada his teaching has had a wide influence. But what is perhaps more noteworthy is the growing mark of Plunkett's thought on the young generation of rural workers in the Far East, particularly in India and in China. It is not then idle to speak of it as a world rural life policy, and I take this opportunity of paying tribute to the memory of one who should never be forgotten by those who care for the development of the countryside. Here at this meeting the three aspects which Plunkett emphasised are again being considered: better farming—the spread of information and education on the subject; better business—the economic planning and organisation of agricultural production and distribution; and finally, better living—the problem of our rural social life and of the community organisation which is necessary for its development. Better farming and better business are in a sense prior to better living. A sound economic foundation is necessary to a good social structure. At the present day it may be said that better business, the middle term, is the centre of the problem. But the end is better living, and the organisation of the rural community to this end.

The phrase " better living " can be considered from two aspects: first, the life of the individual and the family unit in the community; and, second, the wider view of the community itself and its institutions. Even without many of the recent developments in community organisation of the countryside, the march of education makes possible a very great advance in the life of the individual and the family. It affects directly the problem of the family farm which shows a power of persisting and of presenting itself continually afresh to thinkers about rural life. Despite the growth in the mechanisation of agricultural industry and the natural tendency, from a purely economic point of view, towards larger units of production, the fact remains that the family farm reveals a vitality which is due partly to economic, but also largely to social causes. At the present time even in countries which have been moving towards a much more industrial form of society we see the persistence and even the growth of the family farm. The reason for this lies in what Plunkett said—that agriculture is not only an industry and a business, but a life. Farming has this characteristic in a stronger degree than any other occupation. It is because the family farm gives the possibility of a living, however hard, and provides satisfaction for not only the needs but the inclinations and aspirations of the individual, that it continues and will continue to attract men and women who prize the independence and initiative which it allows. And when we speak of the hardships of the family farm we must set against these the uncertainties and the limitations which modern industrial organisation imposes upon the industrial worker. The family farm will remain one of the great factors in our rural life organisation. Not only the family farm but all other occupations on the land, down to the small allotments, make possible a greater and better satisfaction of the daily needs of life. The value of the land as a means of supplementing the resources of large numbers of industrial workers and of providing well-being, if not wealth, is yet far from being realised in this country. There are abundant examples of wonderfully managed individual holdings, just as there are of the benefits of allotments to the industrial community, but a vast amount can yet be done to improve the standards not only of those who live by the land in the countryside, but of the industrial workers who can have a share in the land in the neighbourhood of their homes to supply some of the needs of their families. It is in the development of individual initiative and, above all, through the spread of education, that the standard of living can be secured and raised. Anyone who knows what even a good garden can do to improve the diet and increase the amenities of life as well as to call out and satisfy all kinds of inclinations and aspirations in the individual will recognise how much more welfare and happiness can be secured to the community by well-directed self-help. For it is ultimately on the individual, given the opportunities, that the success of any effort to raise the standard of living depends. This is familiar to us all. The country is old as compared to the town; it is rich in experience and tradition; there is an immense amount of stored-up wisdom in its people; the gardens and the fields of the countryside can in many places show how much has been done in the past. It is necessary then to keep the sense of perspective and to remember that our aim is to take up and to develop good traditions which exist, and to build on what has been done and demonstrated by thousands of farmers and by people in towns as well as in the country.

I have dwelt upon this aspect of individual initiative before passing to the other and more special question of the organisation of the rural community. Here again, while it might seem that the countryside is without organisation as compared with the town, it is less true than the appearance suggests. The rural community has in itself many institutions which have a continuity of life greater than town institutions present. The rural school, the church, and the various ways in which rural community life find expression are something different from their counterparts in a town area. There is in the countryside a continuity of life which is of great value. Again, therefore, while we proceed to stress the importance of some later developments in the organisation of rural life, the strength of the tradition and of the spirit of a rural community must not be forgotten. Particularly is this true of old-established communities like those of Europe and Asia, as compared with the communities of the New World. Yet it is interesting to note that some of the developments in rural organisation have come from the New World back to the Old. Nevertheless the country is still much less organised than the town, as agriculture is much less organised than the other great industries of the community. Gradually this condition of affairs is changing, due in no small measure to the great development of transport and the accessibility of the country to the town and of the town to the country.

Does then the countryside need better organisation ? It may seem to some as if we are highly enough organised and that further developments are superfluous. But let us remember that as on the economic side we are seeing the weakness of unorganised agriculture, so on the social side there is need even in our old communities for new forms of organisation. In any case let us observe what is happening in the twentieth century, and particularly in the last two decades. The New World has been influencing the Old. Year by year we have seen new institutions, some of which had their birth in the New World, taking root in the soil of the Old World. Let us take three illustrations. The Women's Institute movement came from Canada and the United States to this country —and who can doubt that this movement, which has grown so rapidly since the war, has brought about a very great advance in the social organisation of our countryside ? Does not experience suggest we want this movement to spread all over the countryside, and every village to have its Women's Institute ? Some parts of the United Kingdom are as yet almost without such institutions. In Northern Ireland, for example, which has a very large rural population, these institutions are as yet only very few in number. And in England itself, where I submit the movement has made even greater headway than in Scotland, there is still room for much development.

A second institution is of more recent date. The Young Farmers' Movement, which again first developed in the United States and Canada, and since the war has enrolled there a vast army of young people, is taking root slowly but surely in England and Wales and in Northern Ireland. Its great value as an instrument for training the rising generation in the care of animals and the rudiments of good husbandry is recognised. In England there are now some 200 of these clubs ; in Northern Ireland, where the first club was founded in 1930, there are now 50. The movement, which is of particular value to a rural community, can also be of great advantage in semi-rural and even in town communities. It is capable of a vast extension, not only as a training in live-stock and horticultural management, but as a method of organising young people into groups in which they learn the lessons of self-government, of business management and of co-operation, in which, in fact, they receive an admirable introduction to the life and work of the community, This very hopeful movement has not made the progress in Scotland which it has made in England, Wales and Northern Ireland. It has been said by some that the Young Farmers' Movement is not suited to Scottish conditions. But is this so ? Is not Scotland losing something which England and Northern Ireland are gaining ? Again, for those who have passed or are passing from the adolescent stage and are members of the adult community, there are Young Farmers' Discussion Clubs. This is a form of adult education particularly suited to rural needs. These adult Young Farmers' Discussion Clubs are spreading in Scotland, England and Ireland, but there is room for a great development of the movement all over the country. Plunkett used to say that one of his aims in preaching co-operation was that he might work with an organised community. The State can be very much more effective if it is dealing with groups rather than with individuals, and whether it is health, education or any other social service, that service can be very much more efficiently organised in a community rich in group life than where such groups do not exist.

A third movement, which has come into being since the war, was started in this country. The first of the Rural Community Councils, that of Oxfordshire, dates from the year 1921. There are now Rural Community Councils in over twenty counties. In England the movement has proceeded on the county basis with a wide freedom of initiative. One county has pioneered the way in one service, another county in a second. Each county learns from another and quietly the movement spreads, intensively as well as extensively. It provides a means by which all who are concerned in contributing one way or another to the life of the community can co-operate, whether it be in education, or public health, or rural industries, or music and drama. A distinctive feature of the movement has been its relation to the statutory authorities. Our Anglo-Saxon community to-day seeks not simply to be a great State organisation, but to preserve a tradition of voluntarism. Whereas at one time we thought of voluntarism as apart from and even at times opposed to State action, the distinctive characteristic of our modern movement is the co-operation between voluntary bodies and statutory authorities. Organised self-help is the complement of good State aid. Voluntary movements make possible the development by the State of the social services in an economic way. It is here that we touch on the vital principle of good community organisation. We need the picture in our minds of a society in which we have a well-organised State machinery and alongside of it a well-organised voluntary system, the two harnessed to secure the most effective distribution of power, and to call out the initiative of the individual in the service of the community. This is the true way of democracy.

But the Rural Community movement, while it seeks to develop the county community, has as its main objective the better life of the village. One of the most significant trends in the history of the community movement in England has been the growing sense of the need of organising village service councils. You cannot have a strong and permanent rural community movement unless it develops a village community life. This has led to the study of the village community and of how it can be made a more effective unit. A most important factor has proved to be the provision of the village hall as a centre for the social life of the community. Rural communities differ widely in their conditions. Some have little in the way of village life but consist largely of isolated farms and small-holdings and groups of cottages. Even in such places a centre or meeting-place is wanted and though the church and school to some extent provide this, it is recognised that the village hall is part of the good organisation of every parish or village community. In this connection there is a further point to note. The village hall is much more than the provision of a building. The hall should be vested in the control of a representative committee or council. It should not be the property of any one interest, but of the community. Thanks to the Development Commission, the Carnegie United Kingdom Trustees, and the National Council of Social Service, provision has been made to assist the erection of village halls, but in every case it is required that there shall be a representative committee or council. Such a village hall is an institution of deep social significance. In rural life organisation we often fail to see at first the possibilities of a particular movement. This has been true of the village hall which has proved to be a far more fruitful institution than was at first realised. This is also true of the Rural Industries movement. Experience has shown how one step leads to another and how very important the organised movement in favour of rural industries has been in safeguarding and developing the opportunities of different groups of village craftsmen. With the establishment of the Rural Industries Bureau and with the network of organisation which is spreading over the country, a movement of national significance is being built up. So again the Rural Library movement since 1915, thanks to the initiative and continued support of the Carnegie United Kingdom Trustees, gives us yet another example of the great development of rural community services in the twentieth century.

But we are as yet only on the threshold of this work. With the spread of such social co-operation it is possible to develop an organised rural community rich in institutions. The school garden has quickened many a village school, and if we can have grouped with it the village hall and the village workshop where practical instruction in rural crafts and industries can be carried on, then we have built on to our existing system something which is going to make possible a much better rural community life. Yet let it be kept always in mind that we have to build up from the ground with very careful surveying of what exists locally. The rural surveys which have been carried out by the teachers and children in some of our counties, and the attention which is being given to collecting and preserving the data of the history of the parish or village, its traditions, the changes which have come over it, the employments and occupations of its people, are all helping towards the building up of the rural community and adding to the richness of the life of the individuals in it.

But it is not enough to have the village, or even the county organisation. Development is also required on a national scale. Here again voluntary and State aid must go hand in hand. On the voluntary side, the development of the National Council of Social Service has provided this country with an organisation which is more and more able to look out over the whole field, to assist the counties, to bring them together and enable them to co-operate one with another, to be a clearing-house of information and to be an agency which is able to co-operate with the central Departments of Government in thinking out and planning a rural life policy. In the same way the statutory authorities, the Development Commission, the Ministries and Departments of Agriculture, Health and Education, and the Rural Industries Bureau, have all contributed towards the equipment of the community with machinery at the centre for the purpose of rural life development. Thus a well-organised community needs the development of community organisation, locally in the village or parish, in the county or in some larger area which groups the villages for co-operation, and finally in the national unit which looks out over the whole field, and which furthermore, keeps the whole movement in touch with what is going on in other countries.

This development of community life makes possible a greater harmony in the economic sphere. One of the dangers arising from the rapid development of the new economic policy is that a particular interest may be developed at the expense of the community. In an organised community there are safeguards. The economic and the social aspects of life are continually acting and reacting on each other and if there is an organisation which focuses public thought and sentiment, we are less likely to take measures which do not adequately appreciate local conditions and which are therefore liable to provoke passive if not active resistance and consequently to fail in their achievement. We need to plan national life as a whole. Town and country are reacting much more closely one upon the other, and the interests of the town must not be sacrificed to the country any more than the interests of the country should be sacrificed to the town. The problem is to bring out the real harmony in what might otherwise become conflicting interests. The town is going to be helped by a prosperous countryside just as the countryside is helped by the prosperity of the town.

There is still another aspect to be kept in view. Co-operation for one purpose often leads to co-operation for another. It was part of Plunkett's thought that if people were organised for economic co-operation they would realise the advantage of co-operation for social service, and that in co-operating for social service they would find again the advantage of co-operating for economic purposes. His concern was to sow the seed of the co-operative spirit. The great virtue of voluntary co-operation is that it gives scope for individual initiative. We are going to have a community organised, it may be from above, by the State, or it may be by a democratic co-operative movement working with the State and endowed with powers by the State. The rights of the individual are not absolute but limited by the rights of others. Wide powers have been given to the majority to impose conditions which the minority must accept, but true democracy must assure also to the minority the opportunity to have their views heard and to persuade the majority. The fundamental question of freedom comes in, affecting the whole of our social and economic structure ; and agriculture has become in this country, as well as in the United States, almost the spearhead of the new economic policy. We must bear in mind not only that change has been rapid in recent years but that it may be yet more rapid in the years ahead of us. We must be well organised if we are to deal wisely with so complex a situation. We need not only much more careful measurement on the quantitative side of things, but much more patient observation and analysis of the qualitative aspect of our problems. There is a great field for careful study of the effects of different occupations and different modes of living on the happiness of individuals and of communities. It is a problem of imponderables, of the social, one may call them the spiritual, values which cling round the life of the home in our Anglo-Saxon community and which are associated very closely with the land and with local institutions and customs. We are apt in our modern outlook to be so much influenced by industry that we think of hours of work and hours of leisure, whereas in the family farm, by which one means the self-employed, self-directing unit, there is no such sharp division. Social psychology needs to take more careful account of the influence of institutions such as Women's Institutes, or Young Farmers' Clubs, or Rural Community Councils, or of other things like the village hall, on the life of the community. Beyond this lies that still more subtle field of inquiry, the value of which it is difficult ever to reduce to measurable terms or to put in the balance against more material factors—the joy of communion with Nature ; the joy of the life of the country ; the interest in what is living and growing, crops and stock ; the change and play of the seasons ; the peace and quiet which comes in the country and which so often vanishes in the town. Unless we take account of these things and try to realise their significance we cannot wisely plan the life of the community or feel any assurance that we are creating conditions which give to men and women the sense not only of living, but of good living.

May I add that at no time has the significance of what is being done in this country been so great, not only for ourselves but for others. Already the community movement in England, slow as it is, has helped other countries as far afield as India and China. It is one of the wonderful things about agriculture and rural life that it is an experience and a language in itself. There is a great common element in rural life all over the world, especially in the life of the peasant of the family farm. There we have something which goes down to the basis on which civil and peaceful society has been founded. Among the great peoples we, more than any other, have been given over to industrialism. Now at last we are awakening to the meaning not only of agriculture but of the rural community as permanent and invaluable parts of our national life, as sources from which we draw both strength to renew the structure of our civilisation and understanding of the life of other communities. And on this in a very real sense depends the peace and well-being of the world.

# SOME TRENDS IN MECHANISED FARMING

## II—GRASS

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If the cultivation and harvesting of grain has come to take first place in the eyes of the British farmer in the last few years, it is by no special or inherent virtue of its own, but rather as a result of political changes and the development of an economic nationalism : though (as Professor J. A. S. Watson pointed out in his admirable Presidential address to the British Association at Aberdeen) to many farmers, " It is somehow more honourable to plough a field than to let it lie in grass. It is a nobler thing to grow wheat—even if nobody wants to eat it. . . ." But grassland, all said and done, is in some respects the very backbone of British agriculture.

The British Islands are in the main areas of high rainfall, which suits grass and at the same time produces a peculiarly excellent and ingenious type of farmer. He needs to be ingenious, if he is to wrest the grass from a high rainfall area and convert it into a less perishable form : and as the mechanisation of the wheat field is at least the science or art of diddling the weather, so again when the engineer comes to the grassland he finds the same problem ; but with this difference, that grass or unripe hay may contain three or four times as much moisture as uncut grain, and his dried hay is worth as much a ton as wheat is a quarter. It is easy enough to invent a system of artificially drying hay (though not so simple to make the system work), but the three factors of bulk, high moisture content, and the low cost of the final product are veritable millstones round the neck of the unhappy inventor.

There is in average years enough fine weather in the summer months over most of the country to make haymaking a success without artificial help, and in consequence the energies of the engineers have been devoted rather to machines to speed up the cutting, making and collecting of the hay, and the building of the stack, and to reduce the labour required, so that the fullest possible advantage can be taken of spells of fine weather. For the farmer in the wetter areas there are the several systems which have been evolved in Scandinavia and Germany, and the Proctor tripod system—a modification of an old Scottish practice—which works well under the conditions of north-east and western Scotland. None of these, however, can well be " mechanised," and an alternative is still to seek.

Fortunately we are now within measurable distance of a solution, in the suggestion that young grass, in the flush of growth, should be used instead of the ripe and flowering grasses, at the end of their growth. Young grass has a high protein and carbohydrate content, very little fibre, and is rich in " accessory food substances " or vitamins. If cut at this stage, while still only a few inches high, and rapidly dried by artificial means, it can be made into a dark green meal or cake which is excellent for winter feeding and an admirable substitute for other concentrates. Alternatively the same grass may be converted into silage by one of several simple methods, including the recently introduced acid, or A.I.V. process. Even more important from the farmer's point of view is the fact that all young grasses are equally valuable for this purpose if taken at the right period of growth, and that even coarse hill grass like *Molinia* and *Agrostis* may be utilised to make a concentrated foodstuff.

This new development, which is largely due to the initiative of Dr. H. E. Woodman at Cambridge and Dr. H. J. Page at Jealotts Hill, is receiving the close attention of a special Committee of the Agricultural Research Council, and it is expected that some of their findings may be published in the near future. In the meantime, several independent investigators have been drying young grass on a commercial scale in different parts of the country. As an example may be quoted the case of a contractor who had undertaken to keep the grass cut on a number of R.A.F. aerodromes in the Lincolnshire area. It was suggested to him that the cut grass, which he was throwing away as a waste product, might have a commercial value if dried. As a result of this he installed a Ransomes' horizontal band drier, with an output of 4 cwt. dry material per hour at one aerodrome: and after one season's working has now ordered three further driers to work at other aerodromes, this being cheaper than the haulage of the material to one central plant. The young grass was originally cut with a standard cutter-bar mowing machine, and swept up by a horse-rake, thence hand-loaded into carts, but during the season these machines were replaced by one of the special short-grass cutters and loaders designed for the purpose by Messrs Wilder of Reading (Fig. 1). These Wilder machines elevate the cut grass and deliver it into pneumatic-tyred trailers which are towed behind the cutter and changed at intervals. A similar machine in use on the grassland farm of Mr Webster Cory, in the Cotswolds, is shown in Fig. 2. On this farm the grass is made into silage, using the A.I.V. process.

The cost of the Ransomes' drier, without foundations or power, is about £400, and that of the Wilder unit about £160 with one trailer. The total expenditure for an output of 4 cwt. per hour, including two tractors, extra trailers and installation costs would be of the order of £1,000. This figure may seem large at first sight, but as it is possible to work 20 hours per day, with a daily output of 3 to 4 tons finding a ready sale at £7 per ton, it is evident that there is a good margin for working expenses and depreciation. It is understood that similar outfits have been working in Fife and Kirkcudbright during the past summer and have done equally well: in one of these cases the drier was also used for the grain harvest, and the tractors and trailers for other farm work.

The extension of short grass drying on this scale has obvious limitations, chief of which is that the product is at present a novelty on the foodstuffs market, and has not yet found its way into the public notice. Should a firm market develop, dry-grass concentrate might become of some importance as a constituent of rations for winter feeding: for the dairy herd it will be of value in making possible the production of milk of good colour and vitamin content, and in the intensive poultry house it will have the same influence on the yolks of eggs. It is curious to note, in passing, that the English public likes a dark yolked egg, while the American prefers it pale.

Should short grass production for this purpose become of practical importance there will be some interesting problems for the agriculturist: how far soil fertility under grass may be maintained under continuous cutting without the use of animal manure: the optimum rainfall required: quite possibly, indeed, as has already been suggested by Sir Frederick Keeble, irrigation on a large scale may be justifiable, and some attempt made to reproduce the age-old "drowning" of Hampshire water meadows by artificial means.

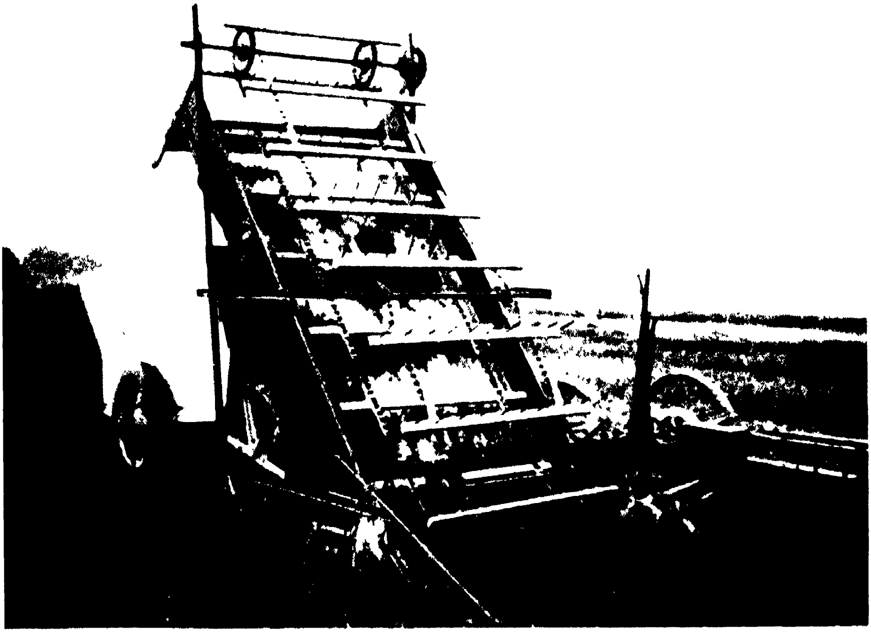

Fig. 1. Wilder's Short Grass Cutter and Loader.

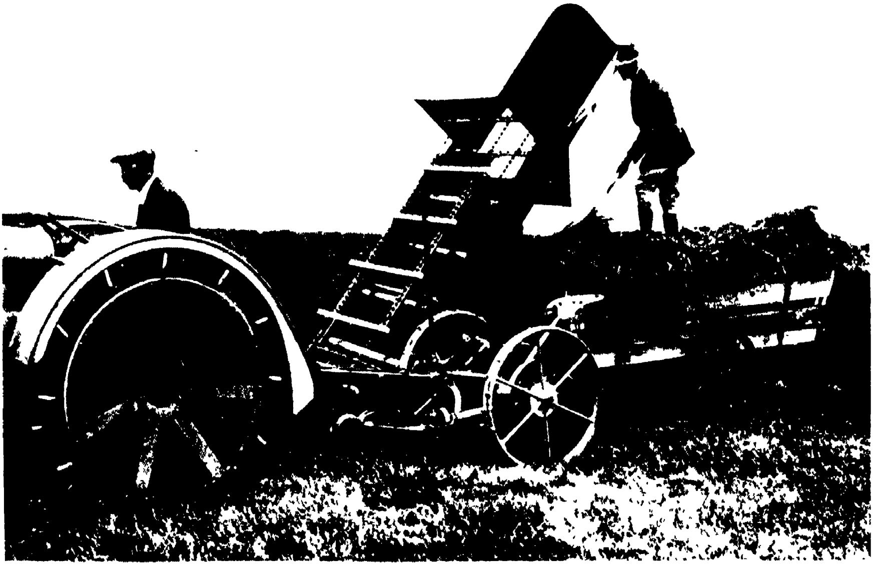

Fig. 2.—Short Grass Cutter and Loader at Work. (*Farmer and Stockbreeder.*)

For the small farmer capital expenditure on the lines indicated is clearly impossible, and there is at the present moment some scope for an inventor to produce a small drier which will be both cheap and easily manageable. There seems no reason why some modification of the simple "tray" driers which have been used successfully for the grain harvest in the last few years should not be used. This design has the advantage that it can be cheaply constructed by local engineers or blacksmiths, the only moving part being the centrifugal fan, which can be bought "over the counter." If these driers were arranged so that the air could be continuously recirculated, a fairly high efficiency of drying could be attained. On the small farm, where drying would only be done occasionally, a "batch" machine would be as useful as the more elaborate "continuous" driers: and quite apart from grass, the same machine could be used for grain, pea haulm, seed clover, lucerne and even beet tops. Such a drier, with a little ingenuity, can be built for less than £50 inclusive, and requires only the type of engine to be found on most farms, or a tractor, for its power. There is a further field for the inventor in the devising of some form of cheap attachment to the ordinary mowing machine which will facilitate the collecting of a swath of blades of grass between three and six inches long—an attachment, be it noted, which must be able to work when the grass is wet.

When the question of grassland mechanisation arose some years ago, doubts were expressed as to the amount of damage which tractor wheels would cause to the sward: and it was very evident on some land that strakes and spuds were not careful with their divots. To-day, the position has been entirely altered by the pneumatic tyre, which, so far as grassland is concerned, has come to stay, and which may even be found on mowing machinery introduced this season. The low-pressure tractor-wheel is still to some extent under trial for general farm purposes, although in nine cases out of ten it can deliver as much horse power to the drawbar, or even more, than the steel wheel. Occasionally, under certain conditions of rain and soil, its adhesion may almost completely disappear; and it should be noted that this is particularly likely to occur on grassland. In ploughing clover, indeed, loss of adhesion may occur under dry conditions, due to the juice expressed from the plants, and it is necessary to fit spuds to the land wheel of the tractor. These wheels have been in existence for only two seasons, both of them exceptionally dry, and further experience under more normal conditions is required before judgment. There are several types of tread available, and it may well be that some of these may prove more effective than others: while it is possible that for all-grassland farms, a higher pressure tyre of smaller cross section on the general lines of the "hill-climbing" motor tyre, may prove more useful. In general, however, more damage is done to grassland by cart-wheels than by tractor-wheels, and the introduction of the pneumatic cart-wheel with its low draught and larger load capacity, has been of the greatest importance. (Under test in this country it was found that the percentage saving in draught was from 13 to 41 per cent, and the increased pay load, for equal draught, from 40 to 108 per cent, according to the state of the ground; in each case when tested against standard farm cart-wheels.)

The first effect of this introduction was the appearance of low-loading tipping farm-carts for horse draught; the second the development of very low-loading two-wheeled trailers for use with tractors (Fig. 3). These trailers (for which complete constructional drawings have been published by the Institute for Research in Agricultural Engineering) have proved very successful on farms where a considerable amount of road work has to be done between outlying fields and the farm buildings, since although unsprung they are capable of taking loads up to two tons at fifteen miles per hour or more.

But quite apart from these specially designed pneumatic tyres for farm work, there has in the last few years been a very great development of the use of ordinary car chassis for high-speed farm work. Second-hand American cars can be bought, inelegant, but still mechanically sound and serviceable, for less than five pounds. Their capabilities on the farm have not yet been fully exploited. Apart from their uses in the hay-field—which will be described later—they are valuable time-savers for light haulage on the grassland farm, carrying foodstuffs to outlying poultry flocks, and in the South, to movable milking bails, from which they return with milk churns. Mr Hosier of Wexcombe has gone so far as to use these cars to drive—not merely pull—pneumatic-tyred trailers. This is done by substituting Ford lorry rear axles; the worm shaft is extended to make a "power take-off," from which a flexible shaft drives a trailer fitted with a similar rear axle. The process may be extended, if a sufficiently powerful car is used, until a "train" of trailers is built up. A similar arrangement, on heavier lines, is used by the Army for roadless districts of the Empire.

The subject of grassland cultivation is outside the scope of this note, but it may be mentioned in passing that Mr. S. M. Bligh, of Cilmery Park in Radnorshire, is experimenting with second-hand cars fitted with hill-climbing tyres as a possible substitute for tractors for this work. His standard method of reclaiming poor grassland is to burn and otherwise destroy bracken, then to manure with 6 cwt. North African phosphate, scratch or scrape with any suitable implement, and sow with ½ cwt. Kentish cleanings—costing 3d. per pound. Up to the present the most suitable implement for use with the car is a spring tooth harrow—but as the cultivation is done at 15 m.p.h., several passages are necessary to do as much work as once over with a tractor. It does not appear likely that the cost of cultivating with a car will compare well with that of tractor work, but as the former is within reach of the smaller hill farm and the latter is not, there is a place for work of this kind.

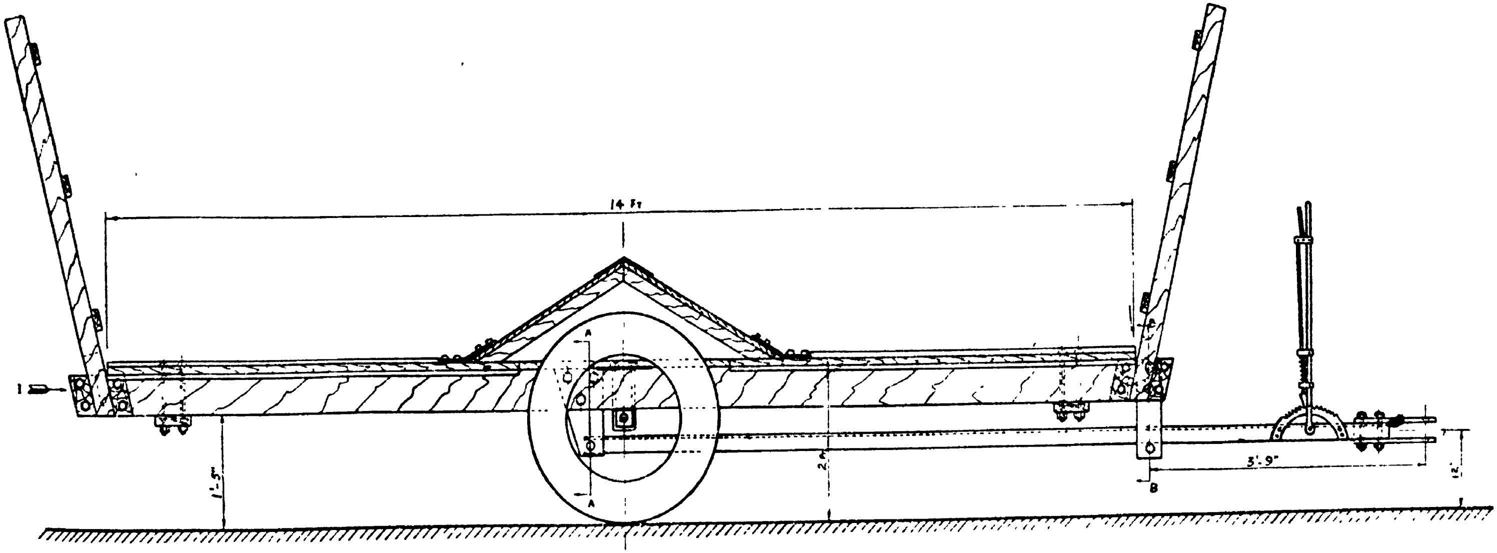

Fig. 3.—Tipping Trailer fitted with Pneumatic Land Tyres.

Scale drawings giving all necessary particulars are obtainable from the Institute for Research in Agricultural Engineering, Oxford, price 2s. 6d. post free.

# MILK MARKETING IN DENMARK

JAMES GRANT, B.Sc.(Agr.)

**Historical Development.**—The dairying industry is not of very long standing as the most important enterprise in Danish agriculture. Though as early as the middle of the seventeenth century more interest began to be taken in it and a little less in grain growing on the larger farms, and though this interest increased, the development did not cause any appreciable change in the farming as a whole, and grain growing remained the predominant enterprise for another two centuries. It was not until the seventies of last century that the middle-sized or peasant farmers turned their attention to dairying, compelled as they were to give up grain growing for export by the slump in prices in the world's grain markets, caused by the flood of cheap grain from the virgin soils of America and Eastern Europe, but when they did turn their attention to it the dairying industry expanded rapidly, and within a comparatively few years attained the position, which it has since held, of the primary enterprise in Danish farming.

At that time there was no co-operative marketing, individual and independent business being the rule of the day. Each dairy farmer marketed, or processed and marketed, his own supply of milk. As early as 1760 the application of the principle of the joint handling of milk for its manufacture into butter and cheese was advocated, and in subsequent years efforts continued to be made to introduce a co-operative system, but these bore no fruit. In 1852 the Royal Agricultural Society called attention to the advantages which might accrue from the setting up of creameries for the joint handling of the milk from several farms, and a decade later—in 1863—the first dairy of that type was set up at Marslev in Funen. In the next few years similar organisations were formed in various parts of the country, but these, like the 1863 model, were not co-operative. Being as they were, however, for the joint handling, manufacture, and marketing of the supplies of milk from several farms, they constituted the first step in the direction of the true co-operative creameries.

There is some doubt as to which was the first co-operative creamery in Denmark, as the organisations and methods of operating the first few were somewhat different and not truly co-operative.[1] The first claimant is the *Kaslunde* creamery, which was set up in Funen in 1875. In it the capital was in the form of entrance fees or shares, and the liability of individual members was unlimited. Each shareholder had one vote and one only, and all matters of dispute were settled by simple majority. There were no delivery contracts, and surplus or deficit was apportioned among, or borne by, the members in proportion to the sum they had received during the financial year for milk supplied to the creamery.

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[1] "Co-operative" is here used in the Danish sense which generally implies as essential principles, *inter alia*, the raising of the initial capital by loan, delivery contracts, and the apportionment of surplus or deficit according to business transacted.

The next " first " co-operative dairy was *Burgaard*, established in 1882. In it the shares were bound up with the delivery of milk from a certain numbers of cows, not only for the time of the original shareholder but also for possible transfer to another in the event of his quitting his farm and leaving the district. In this case the surplus or deficit was apportioned according to the shares held.

The third dairy claimed to be the first true co-operative milk marketing enterprise, and this one probably rightly, was *Hjedding* creamery, established later in the same year (1882) at Hjedding in the west of Jutland. In this case delivery contracts were enforced, and the organisation was definitely co-operative. It was this organisation which was used as the standard model in the development of co-operative milk marketing throughout Denmark. Once properly started the movement spread rapidly. In the next three years—up to 1885—84 creameries were established, and in the following five years an additional 595. To-day the total number of co-operative creameries is 1402, and these are dotted all over the country, drawing their milk supplies from their immediate neighbourhood. There are only 338 private dairies, representing some 19 per cent of the total number in the country, and they do not handle a corresponding proportion of the marketed milk.

**Present Day General Organisation.**—The sale of shares among farmers to obtain capital for the establishment of co-operative creameries is now unknown in Denmark. The local circle of farmers merely bind themselves, usually for a period of ten but sometimes fifteen years, to deliver all their sale milk for joint handling and manufacture at the local creamery. They pay no entrance fee and make no capital outlay, the necessary initial capital being raised by a loan for which the members hold themselves jointly and severally liable. At the end of the contract period there is a complete re-valuation of the creamery, and the surplus or deficit is divided among the members on the basis of business transacted during the contract period. This arrangment seems to work very well, the several liability arrangement giving rise to no difficulties.

Within the organisation itself the liability of each member is in proportion to the value of milk delivered. One year's notice in advance is required for withdrawal from the organisation. In most cases when a member removes to another district (which is seldom, as farms changing hands are comparatively rare in Denmark) the withdrawal is not virtual, as it is usually incumbent upon the incoming farmer to take over the predecessor's contract with the local co-operative creamery.

Business control and supervision is effected by a board of directors of usually seven or nine members. The highest authority is the annual meeting of members, normally held twice a year. In this the one-man one-vote principle is rigidly adhered to, and voting by proxy is not allowed.

**Federation.**—As dairying developed and the co-operative organisations embraced larger and larger areas, it was a natural development when the farmers in the various local circles began to get together to discuss matters of common interest. In the latter half of the eighties and following years special dairy societies were formed for organisation work and other objects, such as the joint purchase of fuel and other materials used in the creameries, in various places for the joint purchase of feeding stuffs for the members, and even as early as this with the object of forming an organisation for the marketing of butter co-operatively.

In the latter half of the nineties and the first few years of the first decade of this century, district creamery associations were formed in most parts of the country, these having as their main object the advancement of butter-making, not only on the technical side but also as regards work for the centralisation of all dairy work and the joint sale and export of butter. From the beginning these associations accepted some private dairies as members where these were operated along lines similar to those of the co-operatives. The membership of the district creamery associations is indirect, that is, the producers are members through their creameries.

There are now twenty-three of these district associations, and they are organised into three provincial organisations, which in turn are federated into the National Federation of Danish Creameries. This central organisation serves and acts as the national organ in all matters of common interest, deals with all questions of importance whether technical or economic, and deals also with all questions affecting the dairy industry in general, such as legislation, government control and regulations, transport facilities, export, foreign markets, etc. Only about fifty of the co-operative creameries are non-members of the Federation.

The National Federation appoints a committee to represent the milk producers in the committee which makes the weekly Copenhagen butter quotation. It also appoints a committee to supervise the work of the Dairy Statistical Bureau in Aarhus, which is maintained by the producers and the State. This Bureau collects detailed information from the creameries as to membership, number of cows, milk handled, butter and cheese manufactured, milk sold for liquid consumption, costs of operating, etc., and in addition collects and publishes price statistics and other material dealing with the production, sale, and manufacture of milk.

In connection with the general advancement of dairying the Danish Dairy Managers' Society deserves mention. It was first formed in 1887 by dairy managers, and since then has worked for the development of dairying in general and for efficiency in creamery management in particular. The membership of the society now embraces the managers of all the Danish creameries, both co-operative and private, and in addition various other interested parties. The creamery workers also have their own organisation, which is similar to a trade union. Its chief aim is to look after the workers' own interests.

**Size of the Creameries.**—The size of the co-operative creameries varies considerably from place to place, and also within the same district. The figures issued by the Statistical Bureau refer to about two-thirds of all the co-operative creameries, and as the sample is evenly distributed throughout the country they may be taken as representative of the dairying industry as a whole. In 1932 the number of members per creamery was 143, possessing 1136 cows, an average of 7·9 cows per member. The membership is composed mainly of middle-sized and small farmers, as is to be expected in a country of small-holdings. According to the Bureau's figures the average classification of the members according to the number of cows owned is : over 20 cows, 6·6 per cent ; 4 to 20 cows, 65·4 per cent ; and less than 4 cows, 28 per cent.

In 1931-32 the milk received per dairy was 3,495,097 kg. (746,525 gallons), with an average butter-fat content of 3·67 per cent. The milk handled by *all* the co-operative creameries is about 90 per cent of the total milk sold in the country, the remaining 10 per cent being handled by the private dairies and producer-retailers.

**Payment for the Milk**—The practice in Denmark is to assemble at the co-operative creamery the whole milk from the individual farms. Formerly most of the farmers delivered their own milk, and this is still done by the farmers in close proximity to the dairies. For the further afield farmers the practice was for the farmers to arrange among themselves to drive all the milk on one route alternately, but now the creamery generally engages one farmer on each route to collect the milk and deliver it to the dairy. The same milk cart returns the milk cans filled with skim milk or whey. Of this about 95 per cent is returned to the producers.

There are explicit regulations as to the freshness and the cleanliness of the milk and the handling of same before it is delivered at the creamery, and these are rigorously enforced. All the co-operative creameries work on a 6 or a 12 months' milk pool, making weekly or bi-weekly or monthly conservative payments, and the balance at the end of six months or a year. Practically all pay according to the quality of the milk. There are several tests, but testing the butter-fat content predominates. In all tests of quality the aim is to arrive at the value of the milk for butter-making, and when that has been obtained the payment for the milk is based on the weekly Copenhagen butter quotation. About 86 per cent of the dairies sending in reports to the Statistical Bureau use the fat per cent method, and about 13 per cent the cream per cent method. An increasing number of creameries is using the Reductase test to classify the milk received into four grades or classes according to cleanliness, and this classification is used conjointly with the butter-fat content test for the payment of the milk. Class 2 is regarded as standard and receives the normal payment, class 1 earns a premium, while classes 3 and 4 suffer deductions. These deductions in 1932 amounted to, on the average, 25 and 48 öre per kg. respectively, equivalent to 2·6 per cent and 5·1 per cent respectively of the average return for the milk in that year.

All the farmers delivering milk to their local creamery receive the same price for milk of the same quality, irrespective of whether it goes to liquid consumption or to the manufacture of butter or cheese. At the end of the financial year the surplus is divided among the members in proportion to the business transacted.

**Milk Production and Utilisation.**—The Statistical Bureau's estimate of the whole milk received by the 1402 co-operative creameries and the 338 private dairies in 1932 was 5085 million kg. (1086 million gallons). Of this 89 per cent was handled by the co-operatives. The total milk production of the country in the same year was estimated at 5485 million kg. (1172 million gallons), and its utilisation was given as follows :—

| Outlet | Million kg. | Million gallons | Per cent. |
|---|---|---|---|
| Butter-making . . . | 4505 | 961 | 82 |
| Cheese-making . . . | 115 | 35 | 3 |
| Condensing . . . . | 15 | | |
| Home consumption on farms . | 400 | 82 | 7 |
| Liquid market . . . | 450 | 94 | 8 |
| | 5485 | 1172 | 100 |

Omitting the home consumption and considering only the marketed milk, about 88 per cent went to butter-making and only about 9 per cent was sold in the liquid market.

Taking only those creameries which sent comprehensive reports to the Bureau, the whole milk received per creamery in 1932 was 3,495,097 kg. (746,525 gallons), and of this 94·9 per cent was used for butter-making, 1·8 per cent for cheese-making, 1·7 per cent was sold for liquid consumption, either retail or wholesale (0·9 per cent and 0·8 per cent respectively), and 1·6 per cent was sold in the form of cream. The average output of skim and buttermilk was 3·24 million kg. (about 700,000 gallons), and of this 94·8 per cent was returned to the farmers, 2·9 per cent was used for cheese-making, and the remaining 2·3 per cent sold retail and wholesale.

**Quality of Butter and State Control.**—As early as the nineties of last century Danish farmers began a voluntary movement to have the creameries use a national trade mark—the well-known Lur Brand—on Danish butter. At first this mark of quality was abused by incompetent dairies, but legislation enacted in 1906, and amended in 1911, put a stop to this, and adopted the Lur Brand as the national mark to be used on all butter exported from Denmark. To prevent abuse of the mark the State set up a butter-testing laboratory in Copenhagen, where samples of butter from about 130 creameries are collected and judged weekly, according to quality and water content. The judging is arranged so that the samples are tested on the same day as the creameries' weekly production normally reaches the British consumer. The official judges are butter merchants, dairy specialists, and butter-makers. When a creamery's butter falls below the legal requirements for the Lur Brand, expert advice is given regarding the defects, and certain penalites may be imposed. If the creamery cannot improve the quality it is prohibited from selling butter for export. The most common fault is to have too high a water content in the product. By law every creamery which desires to use the national mark must send samples to the laboratory immediately it is asked to do so.

Improvement in the quality of the butter has been and is being effected through numerous competitive butter exhibitions arranged mostly by the district creamery associations and the dairy managers' society. The outstanding point concerning the high quality of Danish butter is its uniformity. No two samples may be exactly the same, but there is no material difference in the quality of export butter, no matter in what part of Denmark it is produced. This *standard* high quality more than anything else has been responsible for the popularity it has gained in the British market.

**Uniformity of Supply.**—For a staple food like butter the supply of any particular brand must be comparatively uniform if it is to gain, and hold, an important place in any market. Danish producers have realised the importance of this, and calvings are arranged so as to give a fairly uniform supply of milk throughout the year. Liquid consumption is comparatively stable, just as in Britain, and the variations in the output of milk are immediately reflected in the output of butter. The following table, giving the average weekly production of butter in kg. per creamery in quarter years and the extremes in each quarter, shows that there are no violent fluctuations from season to season.

| | 1931 | 1932 | | | | 1933 |
|---|---|---|---|---|---|---|
| | October Quarter | January Quarter | April Quarter | July Quarter | October Quarter | January Quarter |
| Maximum . | 2305 | 2223 | 2748 | 2481 | 2013 | 2252 |
| Minimum . | 2183 | 2067 | 2206 | 2050 | 1880 | 1980 |
| Average . . | 2234 | 2150 | 2511 | 2199 | 1972 | 2073 |

Taking the year 1932, the average weekly output of butter per creamery was 2208 kg., the highest average in any one week was

2748 kg. (24·5 per cent above the average), and the lowest average in any one week was 1880 kg. (14·9 per cent below the average). Contrast with this the quantities of milk manufactured within the area of the Scottish Milk Marketing Scheme in the period December 1933 to October 1934 inclusive. The average monthly quantity was 3,207,000 gallons, the highest quantity in any one month was 6,135,000 gallons (91·3 per cent above average), and the lowest quantity in any one month was 702,000 gallons (79·1 per cent below average). Placing these figures side by side we have :—

| | Denmark (weekly) | Scotland (monthly) |
|---|---|---|
| Maximum fluctuation, per cent above average . | 24·5 | 91·3 |
| Minimum fluctuation, per cent below average . | 14·9 | 79·1 |

These figures are not strictly comparable, of course, but they make it abundantly clear that the supply of milk throughout the year in Denmark is very much more uniform than it is in Scotland. Actually the figures are in favour of Scotland, as weekly fluctuations are greater than monthly fluctuations. The demand for butter is fairly steady from one season to the next, and the Danes have arranged their output accordingly.

**Production, Home Consumption, and Export of Butter.**—Denmark's total butter production for the year 1st April 1932 to 31st March 1933 is given as 186 million kg. (3,654,000 cwt.), and the home consumption in the same period as 30 million kg., or only 16 per cent of the total production. This gives a figure of 8 kg. (17·6 lb.) per head of the population, but there is reason to believe that that figure is higher than the actual consumption. The National Federation of Danish Dairies puts the figure at between 6 and 7 kg. (13 to 15 lb.), but whatever it is it is remarkably low for a country in which butter production is of such paramount importance. A more recent statement gives the *per capita* consumption in 1933 as 21 lb. Much more margarine is consumed than butter, namely about 45 lb. per head of the population in 1933, as compared with 49 lb. in 1931. Attempts have recently been made to increase the home consumption of butter in various ways, the most important of which is making it obligatory on the part of the milk producers to buy from their creamery a certain number of kg. of butter per 1000 kg. of whole milk delivered weekly. Were this enforced all over the country it would have an appreciable effect on the total home consumption. The consumption of butter per head of the population in Britain is estimated at 23·5 lb.

The great bulk of Denmark's butter production and export comes to Britain. A considerable quantity used to go to Germany, but trade restrictions imposed by that country have resulted in a big decrease in the export to the South. The following figures give the percentage distribution of the butter export of 156 million kg. (3,064,000 cwt.) in the year 1st April 1932 to 31st March 1933.

| | Per cent. |
|---|---|
| Great Britain | 85·2 |
| Germany | 6·9 |
| Belgium | 5·3 |
| France | 1·2 |
| Switzerland | ·6 |
| Other countries | ·6 |
| In hermetically sealed containers | ·2 |
| | 100·0 |

Denmark has been the chief source of our butter imports since 1919. In recent years our imports of Danish butter have been :—

| Year | 1000 cwt. | Year | 1000 cwt. |
|---|---|---|---|
| 1928 | 2016 | 1931 | 2466 |
| 1929 | 2204 | 1932 | 2584 |
| 1930 | 2319 | 1933 | 2519 |

In 1933 the 2,519,000 cwt. from Denmark represented over 28 per cent of our total imports of butter.

Danish butter is not sold on an exchange. All butter, except what is required for local consumption, leaves the creamery at the beginning of each week and moves in a direct channel to the British retailer. There is no storage either in the creameries themselves or in the warehouses of the exporters except what is necessary for storing the week's supply previous to shipment. The creameries themselves are not concerned with the actual export, as they all sell their butter output either to a co-operative butter export association, or to a British buyer in Denmark, or to a Danish butter merchant.

**Butter Marketing and Export Agencies.**—The dairy organisations were at first mainly concerned with the management of creameries and technical improvements. The marketing of butter was for many years left entirely to the local creameries, and these sold their output through private Danish firms or English wholesale houses. Dissatisfaction with the Copenhagen butter quotation and the fact that butter was not always paid for according to quality prompted the farmers in the late nineties to organise co-operative butter export societies. These met keen competition from the private exporters, but notwithstanding they have been able to maintain a steady growth. There are now eleven co-operative butter export associations, with a membership of 622 creameries, spread throughout the country. These handle about 40 per cent of all the butter exported. A point of note is that the proportion of total exports passing through co-operative channels is much less than the proportion of the total butter output manufactured by the co-operative creameries.

Before a creamery can become a member of any of these export associations it must undergo strict tests as to the quality and keeping properties of the butter produced, the uniformity of production, etc. Members are bound by contract to sell all their butter through the association, except what they can sell locally. Six months' notice is required for withdrawal, which can take place only at the end of the fiscal year.

The associations are of the so-called " non-stock " type. What little fixed capital is required is obtained by loan. The member dairies have no initial capital outlay, but they are jointly liable for any financial obligations incurred by the association. (There is one exception to this—" Danish Dairies.") The amount of fixed capital is very small, as all that is necessary is office and warehouse. There is no storage of butter beyond the week's supply.

The management of these associations is in the hands of committees appointed by the chairman and managers of the member dairies. An experienced butter merchant manages the actual export business.

All butter received is graded and paid for according to quality. Testing and grading are carried out weekly under strict control by judges selected from the trade, dairy managers, and government experts. The average quality is then given the current week's Copenhagen butter quotation, better quality receiving a premium and poorer quality suffering rather a severe deduction. This payment is generally deferred for one week so as to supply the association with the necessary working capital. Small deductions are made from the weekly payments to the reserve fund, and in most cases to a special fund for the insurance of the butter. Surplus earnings are distributed between the members at the end of the year in accordance with the business transacted. Strictly speaking, from the principle of operation—returning to the creameries the price received for the butter less expenses—there ought to be no end-of-year surplus, but because of the conservative policy in paying for the butter there always is.

Most of the sales of the export associations are to wholesalers and large retail buyers in Britain by weekly telegraphic communications at rates f.o.b. Denmark. Some of the associations purchase raw materials for their members and supply them at current market rates, the profit from this trading being distributed in the form of prizes to the best creameries.

Of the remaining 60 per cent of Denmark's butter export about half is handled by the English Consumers' Co-operative Wholesale Society and the Maypole Dairy Company. The C.W.S. has its own purchasing depots in Denmark and its own representatives, who buy direct from the creameries, usually on contract for three to six months or a year. The basis of payment is the Copenhagen butter quotations as a minimum plus (usually) an " overprice "—an overprice which has a tendency to depress the Copenhagen butter quotation by just that amount. Maypole Dairies have also their own depots and representatives, and do their purchasing and pay for the butter in practically the same way as the C.W.S.

The remaining one-third of the butter export is handled by the smaller British buyers in Denmark and the private Danish butter exporters. There are twenty of the latter.

**Milk and Butter Price Quotations.**—The milk price-quoting committee of the Danish Dairy Association issues every Thursday two quotations for whole milk (ex-farm and ex-dairy) and one for skim milk. The latter is fixed in accordance with the value of skim milk for cheese production. The quotation for whole milk ex-dairy is based on the official butter quotation, and is calculated by dividing the butter quotation by the number of kg. of milk required to produce one kg. of butter, and adding to this the skim milk quotation. The quotation for whole milk ex-farm is the quotation for whole milk ex-dairy minus the working expenses, which are taken at 1½ öre per kg.

The Copenhagen milk price-quoting committee fixes every Thursday the wholesale price of milk delivered in Copenhagen. The committee consists of eight members, four representing the vendors and four the purchasers.

The official Copenhagen butter quotation is made every Thursday and issued through the stock exchange. The committee responsible represents on the one hand the dairy associations, in other words the milk producers, and on the other the wholesalers' society. The basis of the quotation is the actual price which Danish butter has been able to fetch on the world market in the previous week, and the " feeling " of the market for the following week.

**Cheese Production and Export.**—At present 86 per cent of the 558 creameries which manufacture cheese are co-operative in organisation and 14 per cent are private enterprises. The production in the latter, however, is somewhat greater than in the co-operatives, as they produce some 20 per cent of the total cheese sold. Denmark's total cheese production in 1932 was 26·1 million kg. (513,000 cwt.) and sales in that year amounted to 24·2 million kg. (475,000 cwt.), of which the home market consumed 76·4 per cent and 23·6 per cent was exported. Of the quantity exported Germany took 81 per cent and England 6 per cent. Cheese production is relatively unimportant.

**Cost of Operating the Creameries.**—The Statistical Bureau do not include the cost of cheese-making in their calculations of expenses, and of necessity they must be excluded here. In 1932 the working expenses, as given by the Bureau, amounted to 1·102 öre per kg. of milk handled. Expenses vary greatly according to the size of the creamery—from 1·020 öre per kg. for creameries handling over 5 million kg. of milk per annum to 1·399 öre per kg. where less than 1 million kg. is handled annually.

**Net Return.**—The net return from the milk is largely dependent upon the price of butter, and fluctuates with it. According to the Statistical Bureau's figures it was 9·3 öre per kg. of whole milk handled in 1932, as against 10·6 öre in 1931 and 12·6 öre in 1930. This net return figure is the nearest obtainable for the average paid-out price to the producers.

**The Liquid Market.**—There is only one liquid market of importance in Denmark and that is Copenhagen, a city which, including the suburbs, has a slightly bigger population than all the provincial towns put together.[1] Of the provincial towns only three have a population of over 50,000, and for these, as for the numerous small towns, the milk required is supplied from the immediate vicinity—by private dairies, co-operative creameries, and producer-retailers. The right to the small liquid market in these towns is in most cases keenly contested. Price-cutting is prohibited, but other methods of gaining favour can be and are used, particularly giving cream having a higher fat content than the standard. The delivery of town supplies in most cases lacks economic organisation.

The Copenhagen supply is drawn mostly from the island of Zealand, but not all of it, some being drawn from the neighbouring islands. The approximate quantities of different grades of milk sold in the city per day are as follows (June 1933 figures):—

| | Litres[2] |
|---|---|
| Whole milk (*a*) raw | 113,000 |
| (*b*) pasteurised | 61,000 |
| (*c*) stassanised | 21,000 |
| Cream (*a*) No. 1 (over 18 per cent) | 3,000 |
| (*b*) No. 2 (over 13 per cent) | 8,000 |
| (*c*) No. 3. (under 13 per cent; usually 9 per cent) | 11,000 |
| Skim milk (*a*) to private consumption | 4,000 |
| (*b*) to bakeries, etc. | 35,000 |
| Children's milk (sterilised) | 11,000 |
| Jersey milk | 4,000 |
| Buttermilk | 12,000 |

About 90 per cent of the milk is sold in bottles, the rest in cans. State regulations govern the quality of the different grades, the methods of treatment, handling, sale, and delivery. Producer-retailers and small companies play an important part, but the bulk of the supply is handled by four large companies—*Trifolium, Maelkeforsyningen, Enigheden,* and *Andels Mejerienes Maelkesalg.*

*Trifolium* is in certain respects co-operative in organisation, *e.g.*

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[1] 1930 Census figures:—

| | |
|---|---|
| Greater Copenhagen | 796,451 |
| Provincial towns | 787,742 |
| Rural distrsict | 1,966,463 |
| Denmark | 3,550,656 |

[2] 1 litre = ·21998 gallon. Approx. 4½ litres = 1 gallon.

the shareholders are the milk producers, but it is run along purely joint-stock lines. It is a company of Danish estate farmers in the vicinity of Copenhagen and surrounding district. The shareholders, as producers, are bound by contract for twenty years at a time. This company is, as the others, by a law enacted comparatively recently, not allowed to have retail shops of its own—it can only sell from door to door and supply retail shops not its own. This company also manufactures butter and cheese, the former entirely and the latter mostly for the home market.

*Maelkeforsyningen* is in every way a private joint-stock company which handles the milk from some thirty-five farms in Zealand and Lolland-Falster. The milk is paid for on a basis similar to that used by the provincial creameries. Butter is made for the home market.

*Enigheden* dairy is also a joint-stock company, but here the vast majority of the shares are held by the Copenhagen workers' societies, which are largely co-operative in organisation. It is almost a consumers' co-operative concern. The milk handled is obtained from about forty farms and from other dairies, two of which belong to the company. Butter is made and also bought in from other companies for retailing.

The name *Andels Mejerienes Maelkesalg* (literally, the co-operative dairies' milk sale) is misleading, as it implies co-operation when in actual fact it is a strictly private joint-stock company which buys its milk from nine co-operative creameries in the country and retails it in the city. It is a private distributing agency and nothing more.

In all there are 250 retail carts and about 2400 retail shops selling milk and dairy products in the city. There are no purely dairy shops—all sell other commodities in addition to milk, butter, and cheese. As in the provinces, the town milk supply lacks economic organisation.

**Retail Prices.**—The retail prices for milk in Copenhagen in June 1933 were as follows :—

| | Öre per litre[1] | |
|---|---|---|
| | Bottled | Not bottled |
| Whole Milk | 26 | 21 |
| Children's milk | 36 | .. |
| Jersey milk | 43 | .. |
| Skim milk | 11 | 9 |
| Buttermilk | 19 | 17 |
| Cream No. 1 | 200 | .. |
| No. 2 | 110 | .. |
| No. 3 (*a*) ordinary | 70 | .. |
| No. 3 (*b*) export | 65 | .. |

The average retail prices in 1932 were about 1½ öre per litre more than the above. The four big distributing companies declined to disclose the actual paid-out prices to the producers or to disclose the marketing margin they required. Taking the paid-out price at 10 to 11 öre, the margin would be about 60 per cent of the retail price of whole milk. (The figure 10 to 11 öre per litre is based upon a knowledge of the conditions in the month considered above, but it is nevertheless only an estimate.)

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[1] Par rate of exchange = Kr. 18·16 (= 1816 öre) to the £1; approx. 4½ litres = 1 gallon; 26 öre per litre (whole milk) = approx. 1s. 3½d. per gallon.

**Conclusion.**—In the local co-operative creameries certain principles are worthy of note. The first of these is the method of financing. The raising of the necessary initial capital by loan on the joint security of the members has the advantage that it leaves the farmer's share of the fixed capital in his own hands where, under normal circumstances, it earns, or should earn, more than the interest he has to pay on his share of the loan. Further, the interest payable on the loan is borne by the members in proportion to the quantity of milk delivered by them, in other words in accordance with the use they make of the loan. The interest burden is therefore divided in the most equitable way, and there is no cause for complaint. On the other hand the liability of the members is joint and also several, which does not appear to be in keeping with the other side of the question—the payment of interest on the loan. Joint liability of the members on the basis of business transacted would be an improvement, but in Denmark cases of failure of co-operative creameries are practically unknown, and the present principle of joint and several liability can therefore be retained without great risk to the members.

The systems used in the payment for the milk have much to commend them. Payment for a commodity should always be based upon its quality and the value of the ultimate product. The payment according to quality is also at all times an incentive to better the quality. This applies to both milk and butter.

The organisation of the milk producers in Denmark has been built up voluntarily by the producers themselves. Starting with the local co-operative circles, co-operative milk marketing followed what may be regarded as its natural course by developing into district associations, then provincial organisations, and finally a national federation. Each of these, from the local circles to the provincial associations, acts independently within itself but is at the same time closely associated with its fellow organisations, and for the representation of the whole dairy industry in its dealings with other industries, the State, and abroad there is the national federation. That the organisation is economically sound has been amply proved by what it has accomplished. It is no exaggeration to say that had it not been for co-operative effort the Danish dairy industry would never have developed to its present state. Further, the Danes have realised all along the importance of studying the particular tastes of the consumer as regards quality, as well as the demand of the market as regards quantity, a study which the British farmer has not yet sufficiently realised is an absolute necessity in any serious attempt to capture a market. In addition, it must be remembered that the effort in Denmark was made by the producers themselves. Only when a considerable butter export had been established, and when a national trade mark had been in use for some years did the State, realising the economic importance of the British market, step in with legislation to put a stop to the abuse of the national mark and to maintain a uniform high standard of quality. In that and all other respects the milk producers themselves have taken the initiative, and to-day the vast majority of milk producers are co-operatively organised and supply their milk to their own creameries for the manufacture of butter which is largely exported through their own co-operative export associations, with the result that the producer receives for his milk the highest possible value in relation to the value of the exported butter.

There is now a tariff of 15s. per cwt. on all imports of foreign butter into the United Kingdom, but it has not affected the Danish dairying industry to any appreciable extent. The tariff itself is not so much objected to as the fact that Empire countries have not to pay it, and Denmark is justifiably afraid of extension of our preferential treatment to the Dominions, particularly as our imports from New Zealand and Australia have increased considerably in recent years. In 1933 our butter imports from New Zealand practically equalled those from Denmark.

It is rather remarkable, in a country where the milk producers are organised to such an extent, that the supplying of the liquid market has to a large extent been neglected, as far as organisation work is concerned. The distribution is effected partly by producer-retailers and co-operative creameries, but the private distributing agents are the most important. It would appear that the home liquid market has been largely neglected by the producer in favour of a foreign market, owing, no doubt, to the fact that the net returns from milk sold for butter-making and from milk sold wholesale for liquid consumption have differed only slightly. The system of distribution is at present very wasteful ; if it were properly organised and competition eliminated or drastically curtailed, the costs of distribution could be greatly reduced. Improvements in road transport are tending to make matters worse, as producers at greater and greater distances from the city are finding it possible to enter the liquid market and obtain a greater net return than is possible from selling to the local creamery. Were it not for the strict regulations governing the production, handling, and treatment of milk for liquid consumption there would no doubt be more producer-retailers than there are. It must be remembered, however, that the liquid milk market in Denmark is insignificant when compared with the production of butter. The dairy industry looks to foreign markets for its income.

# SOME FACTORS INFLUENCING THE STANDING POWER OF OATS

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ONE of the great problems for the farmer who grows oats is the difficulty he has in getting his crop to stand until harvest. A heavy crop of oats is often laid by wind and rain and, in a great many cases, the expenses of harvesting, the loss of grain, and the deterioration in the quality of the sample make the crop much less likely to leave a profit than one which was originally very much less in bulk. This is especially the case when the oat crop is taken, as it very often is, after lea, when a good sole of grass with a large proportion of wild white clover has been ploughed down. When the oats are taken as "yaval" or on clean land there is not usually the same difficulty with lying corn.

Observations at Craibstone indicate that the crop is most likely to lodge when heavy rain follows a period of very active growth. Very often in June and July, if there is plenty moisture in the soil and the weather is warm and forcing, the oat crop grows very rapidly, but the growth is soft and the crop is very likely to be laid if adverse weather conditions follow.

In 1930, for example, there was a spell of warm weather in July which forced on a rapid growth, and this was followed by heavy rains on the first two days of August. In the Standing Power Trial at Craibstone some of the varieties—Star, Victory, Record, Glasnevin Sonos, and Marvellous—were slightly laid. During the next fortnight these rose again fairly well, but in the third week of August there was very heavy rain which caused some of the varieties to lodge very badly. The position at that time was :—

Standing : Elder, Yielder, Pure Line Potato, and R. 30.
Leaning : Record.
Slightly more leaning : Glasnevin Sonos.
Lying : Marvellous.
Badly laid : Star and Victory.

At the end of the month more rain sent Pure Line Potato and R. 30 slightly down, and when the oats were cut in September the order of standing was as follows :—

Standing : 1. Elder.
Very little leaning : 2. Yielder.
3. Pure Line Potato.
4. R. 30.
Down : 5. Record.
6. Glasnevin Sonos.

Badly down : 7. Victory.
8. Marvellous.
9. Star.

The opinion is freely held that the factor mainly responsible for the failure of the oat crop to stand is the large quantity of nitrogen in the soil after lea, due to the use of wild white clover. But was there not just as much lying corn before the use of wild white clover became general ? The soil was not so well supplied with nitrogen, but the varieties of oats grown before the introduction of wild white clover were all of the straw-producing, or, at best, the intermediate type. These oats are extremely liable to become laid, and, at the time they were more commonly in use, there was probably more lodging of oats than there is now. Even on clean land these varieties went down, especially when, as was usually the case, they were late sown. Almost coincident with the introduction of wild white clover was the more general use of the bigger grain types of oats which are, generally speaking, much stronger in the straw and do not tiller so freely. Consequently they stand very much better than the older types.

Oats are much more liable to go down on some soils than on others. On a clay soil the crop usually stands well, owing to slow growth along with a plentiful supply of moisture. On a sandy soil, too, there is usually a good standing crop of oats, as generally there is not enough moisture in such a soil to allow a rapid soft growth. Low-lying soils in sheltered situations, and especially peaty soils, are likely to carry lodged crops because these soils force on a soft luxuriant growth, the stalks of the plants are usually weak, and the crop goes down at once if it gets heavy rain.

Apart from conditions of soil and season, the factors which seem to exert the greatest influence on the standing power of oats are—variety, time of sowing, thickness of seeding and grading of seed, and manuring.

**Variety.**—Generally speaking, the varieties of oats with the strongest straw belong to the newer big-grain types. These are all grain producers and yield a less proportion of straw to grain than the older intermediate or straw-producing types. Potato and Sandy Oats, for example, have always been known as poor standing oats likely to be laid under adverse weather conditions. All the big-grain oats, however, are by no means good standing varieties. Victory, one of the best-known and most commonly grown oats in this class, does not stand at all well under certain conditions.

Obviously, varieties of oats which ripen early will be superior to late-ripening varieties as regards standing power, and this factor is at present receiving considerable attention from plant breeders. A new variety from the Scottish Plant Breeding Station, Early Miller, is very promising in respect of earliness and standing power. Varieties not usually regarded as resistant to lodging, like those of the Potato and Sandy types, do not as a rule suffer badly in this respect if they mature early. At Craibstone in 1932, in a trial of these types, the varieties ripened in the following order—Pure Line Potato and Utility, Sandy and Scots Berlie, The Bell, R. 30, Gordon, Castleton. The standing power order was almost the same—Pure Line Potato, Utility, Scots Berlie, R. 30, Gordon, Castleton and Bell, Sandy. An important factor influencing earliness of maturity in late districts is changing the seed. At Craibstone this is specially marked with the late varieties. New seed from early districts has given crops which ripened as much as ten days earlier than crops from seed of the same variety locally grown.

The following are notes on the behaviour of some of the better-known varieties in the Standing Power Trial at Craibstone.

*Yielder* is one of our earliest oats and has done well in all the standing power trials at Craibstone. It stands up well against rain but it suffers if there is high wind when it is nearly ripe. It should therefore be cut early. Early cutting, too, will help against another weakness of this variety—its tendency to shed its grain.

*Pure Line Potato* is also an early oat which stands remarkably well for its type. It is somewhat shorter in the straw than Castleton and has not yielded so well when both have been standing. The head is close and the ears are a solid mass of grain, and in a wet season it sprouts readily in the stook.

*Early Miller* is almost as early as Yielder and gives a good return of grain and straw. It has not yet been severely tested for standing power, but its earliness and appearance point to its doing well in this respect.

*Marvellous* is a little later than Pure Line Potato and gives a good yield of both grain and straw. When first grown at Craibstone it was much earlier than it is now and it stood up very well to rain, but it has lost its standing power as it has fallen off in earliness.

*Record*, which has a reputation for standing well in some districts, has never done very well at Craibstone. It is somewhat late in ripening, it gives rather a poor yield, and it does not stand well. A new stock of seed from the south has given a slight improvement.

*Superb* is grown by many farmers as a good standing oat. It is very early but has never shown itself to be a particularly good standing variety in the Craibstone trials. It gets very badly broken by wind and rain.

*Victory* after lea has not proved a very good standing variety but it has stood very well after turnips. It is a late variety.

*R.* 30 is a selection of the Potato Oat type. It is shorter in the straw than Castleton and a little later in ripening, but has not shown itself to be a particularly good standing variety. It always gives the best result with a comparatively thin seeding.

*Elder* is a very late variety which has stood well in the Craibstone trials. It yields well, usually giving more grain than its appearance would indicate. It is a suitable variety for good land in an early district.

*Star* ripens earlier than Victory and has always yielded well, but it is weaker in the straw than Victory and is not satisfactory under our conditions from the standing power point of view.

*Castleton Potato* is grown to a considerable extent in the North of Scotland. It is a medium early oat and it goes down very badly under adverse weather conditions.

In 1928 several varieties of oats with a good reputation for standing were obtained from America, and included in the variety trials at Craibstone. They were tested against Yielder and Abundance, both of which stood well. Several of the varieties—Albion, Gopher, Iogold, States Pride, and White Cross—were very early, about three weeks earlier than Yielder, but the yields in every case were much less. Albion and Gopher were short in the straw and stood while the others were slightly laid. Wisconsin Wonder and Eldorado 37 were about a week later than Yielder and both stood well, but did not give a satisfactory yield. The late varieties Lee and Minota were badly laid and Markton was slightly laid. Idamine, which produced a heavier crop than Yielder and was about equal to it in earliness, was only slightly leaning. Further trials with the best of the varieties showed them to be unsuitable for our conditions.

In 1933 three more American varieties—Alaska, Minrus, and Anthony—were tried. They stood, but were so early that they were destroyed by birds. They were grown again this year but gave no indication of being in any way superior to our own types.

**Time of Sowing.**—During the past few years Potato and Victory Oats have been subjects of investigation at Craibstone and, among other points, the effect of the time of sowing on the standing power has been carefully observed. Plots of these varieties are sown starting on 1st. March, or as soon after that date as conditions will permit, and continuing at weekly intervals till the beginning of May. The early sown plots give a heavier yield of grain and straw than the later plots. Although the results vary somewhat in different seasons, on the average there is little difference between the yields of the March sowings, but generally speaking after the 1st April for every day that sowing is delayed there is a loss of about ¼ cwt. of grain per acre. It has been observed, too, that in seasons where there is lodging the early sown plots stand very much better than the late sown. In 1928 there was no reduction in the yield in any of the plots sown before the middle of April, but the later sown plots fell off slightly. In that year there was a plentiful supply of moisture in the soil throughout the whole growing season and the later sown plots did not suffer to the extent that they usually do. There is very often a dry period in June and the later sowings suffer at that time. All the plots of Potato Oats were laid, but the early sown plots were the last to lodge and were in quite good condition. All the March sowings of Victory remained standing while the later sowings were all laid. The early sown plots ripened earlier, the plots sown on 22nd March being ripe a fortnight earlier than those sown on 19th April, and the sample of grain from the earlier sowing was much more even and of better quality than that from the late sowing. Again in 1929 all the plots sown in March were standing, those sown in the first week of April were slightly laid and the lodging got worse with every week up to the last sowing, which was flat from side to side. As in 1928, there was plenty of rain in May and June, and the reduction in the yield of the later sown plots was not so marked as usual.

**Thickness of Seeding and Grading of Seed.**—In 1928 a plot of Victory Oats was sown with 2½ cwt. per acre of ungraded seed, and during the whole season the growth was very irregular and at harvest time the crop was lodged. The small grains were sifted out from the same quantity of seed and the remainder, about 2 cwt., was sown on a plot alongside. The graded seed gave a better yield and the crop was more regular in growth. The stalks were longer and more uniform, the ears were larger, and the whole crop was standing when it was ripe.

In 1929 the following results were got from a similar trial, again with Victory Oats :—

| | Cwt. per acre | |
|---|---|---|
| | Grain | Straw |
| 1. 300 lb. ungraded seed . . . . | 28·5 | 51·2 |
| 2. 224 lb. graded seed . . . . <br>(Same amount taken and 76 lb. small grains sifted out.) | 29·7 | 50·6 |

Plot 1 was slightly thicker, but many of the stalks were weakly and the crop was slightly laid. Plot 2 was much more uniform, the ears were larger and the crop was standing. There was a better yield of a standing crop with a considerable saving of seed.

In 1932 300 lb. of an ordinary sample gave a yield of 22·8 cwt. of grain and 31·6 cwt. of straw, while 224 lb. of ungraded seed gave 24·4 cwt. of grain and 32·8 cwt. of straw. The bushel weight from the graded seed was 43½ lb. and from the ungraded 42 lb. There was no lodging in any of the plots, but it was noted again that the plants from the ungraded seed were much more irregular in size and growth than those from the graded seed.

A similar result was got in 1933, which was a very dry season. The same grading was used as in previous years, and the 300 lb. of seed gave 18 cwt. of grain and 36 cwt. of straw, as against 21·5 cwt. of grain and 48·5 cwt. of straw from the graded 224 lb.

What is undoubtedly a very important point with regard to the standing power of oats is the thickness of the seeding. Thick sowing has been found to have a marked effect on the date of ripening: it usually gives earlier ripening than thin sowing. A diminution of 25 per cent in the seeding rate has led at Craibstone to the crop ripening about a week later. This difference in time of ripening depends to a certain extent on the season, and is much wider in a late than in an early season. At the same time, while the thick seeding is likely to be earlier, it is also much more likely to be lodged than a thinner seeding. In one of the variety trials at Craibstone the seed was sown with an ordinary broadcast machine and one side of the machine sowed at about five bushels and the other at about seven bushels per acre. The thick seedings were shorter and thicker than the thin seedings and in several cases the thick seedings were lodged while the thin seedings were standing. There was little difference as regards yields of grain and straw. So far as yield of grain and straw is concerned, the Craibstone experiments show that, in the case of big-grained varieties of oats, the seeding may vary within comparatively wide limits without having much appreciable effect. (See "Notes from Craibstone," *Scottish Journal of Agriculture*, Vol. XVI, No. 2.) In the 1933 trials a number of varieties was sown at various thicknesses from 1½ cwt. to 3 cwt. per acre. Only one plot was laid—Castleton Potato Oats sown at 3 cwt. per acre. In the 1934 trial the plots with Victory Oats at various thicknesses gave a very striking result. The plot seeded at 3 cwt. per acre was laid ; that at 2½ cwt. per acre was slightly laid ; 2 cwt. per acre was leaning ; and the thinnest seeding—1½ cwt. per acre—was standing. Three of the varieties were standing in all the plots—Elder, Pure Line Potato, and Yielder. Star was standing in all except the thickest seeded plots, where the crop was lodged in spots. All the plots, thin and thick seedings, of Potato Oats were laid.

**Manuring.**—Various trials have been carried out at Craibstone to test the effect of different manurial materials and of complete manures on the standing power of oats. In 1929, for example, several varieties of oats were grown after lea in which there was a good sole of wild white clover, and were manured with ¾ cwt. of sulphate of ammonia and 2 cwt. of superphosphate per acre. Part of a duplicate plot of Star remained untreated, and it came away very much more slowly than the manured part, and in June it was only about 6 inches high compared with 12 inches where the manure had been applied. The manured part kept this lead and was ripe seven to ten days earlier, and it was not so badly laid as the unmanured part.

On one of the rotation experiments at Craibstone the manuring of the oat crop after lea is as follows :—

Plot 1. No Manure.
,, 2. Sulphate of Ammonia, Superphosphate, Muriate of Potash.
,, 3. Sulphate of Ammonia, Ground Mineral Phosphate, Muriate of Potash.
,, 4. Sulphate of Ammonia, Muriate of Potash.
,, 5. Superphosphate, Muriate of Potash.
,, 6. Sulphate of Ammonia, Superphosphate.

Plot 2—complete manure with superphosphate—has consistently given the best yield of the earliest and best standing crop. Next in earliness to No. 2 is generally plot No. 6—no potash—but the yield is not so heavy. Plots 3, 4, and 5 are considerably later than No. 2 and the yields, particularly on the no nitrogen plot, are much poorer. The no manure plot always gives the poorest yield, and is always latest in ripening. None of these plots has been laid, but the danger of lodging is always greatest with those which ripen last, as they may even be laid after the earliest plots have been cut.

In 1930 at Craibstone a crop of Victory Oats was grown after lea on low-lying land somewhat sheltered by trees; this part was specially selected because the crop on it was likely to go down. One plot was dressed with Kainit at the rate of 4 cwt. per acre and another with common salt at the same rate. The crop was all laid and there was no evidence that the salt or the Kainit helped the standing power in the slightest degree.

Trials with the manuring of lea oats have also been carried out by members of the County Staff of the North of Scotland College of Agriculture, and these showed that the best crops for yield, earliness, and standing power were got when big-grain oats received a moderate dressing of manure containing nitrogen, phosphate, and potash. With intermediate and straw-producing types of oats, however, the use of artificial manures increased the tendency to lodging.

The probable reason for the success of the artificial manures, including nitrogen, on lea oats, is that the manurial materials in the soil are not available to the plant early enough in the season, and that a moderate dressing of a complete manure at the time the seeds are sown gives the plant a good start, and consequently it is more fully developed by the time the soil stores, especially the nitrogen of the wild white clover, become available.

**Conclusion.**—The oat crop most likely to stand well on land into which a rich turf is ploughed is a crop of an early-maturing, strong-strawed variety of big-grain oats of which a comparatively light seeding of graded seed is sown early and which gets a moderate dressing of a complete artificial manure.

## "THE SOCIETY OF IMPROVERS"

ALEX. M'CALLUM, O.B.E., M.A., LL.B.

IN previous articles[1] in the Journal some account was given of the wretched state of agriculture in Scotland at the beginning of the eighteenth century, of the improvement which took place after the Union of the Parliaments, and of certain agencies which helped to produce that betterment. Reference was made specially to "the Honourable the Society of Improvers in the Knowledge of Agriculture in Scotland," and in the belief that it may prove not uninteresting some further account of the Society is now given.

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[1] An Early Scottish Improver, *Scot. Jour. Agric., Vol. XVII, No. 2.* The Diffusion of Scientific Knowledge to Farmers—Scotland, *Scot. Jour. Agric., Vol. XVII, No. 4.*

The Society was formed at a meeting held in Edinburgh on the 8th of June 1723, at which the following resolution was adopted :—

"The Noblemen and Gentlemen mentioned [in the sederunt] considering in how low a state the Manufactures in Scotland are, and how much right Husbandry and Improvement of Ground is neglected, partly through the want of Skill in those who make Profession thereof, and partly through the want of due Encouragement for making proper Experiments of the several Improvements that the different Soils of this Country are capable of :

"Therefore, being willing and desirous to contribute to the Advancement of so great a Benefit as may be reaped from the two Articles mentioned, they do resolve to meet once in every fourteen Days of the Months of June and July, November, December, January and February ; and to have under their consideration such Measures as may be proper for advancing the said Ends."

The Noblemen and Gentlemen who supported the movement and became members of the Society are named in a list prefixed to the volume of *Select Transactions* which was issued in 1743 and which we shall notice later. The names include those of three dukes, two marquises, nineteen earls, twenty-five lords, forty baronets and knights, sixteen judges, sixty or more lawyers (mainly advocates), six doctors and a professor of anatomy, a professor of mathematics and other two mathematicians, five merchants (one of whom is styled "seedsman to the Society"), two booksellers, one engineer, three ex-Lord Provosts of the City of Edinburgh, and many landowners designated from their estates in all parts of the country. Two gardeners are specified, but it is significant that not one of the members is called a farmer, although doubtless a great many of the landowners themselves farmed portions of their family estates.

The membership fees were modest: "each intrant [shall] pay a Crown at his Entry and thereafter yearly a Crown at the anniversary Meetings;" but farmers and gardeners were to be admitted gratis if found by the Council to be qualified for this privilege. The revenue from these fees was to be expended in "purchasing such Books as the Society or Council shall think proper for carrying on the Ends thereof, in paying Secretaries' Fees, Expences of Experiments, and other Incidents of the Society as shall be directed."

A Council of twenty-five was appointed, of whom thirteen were to be residenters in and around Edinburgh, and this Council was directed to divide into Classes—what we would call Committees—each Class to take up a special line of investigation or discussion and to record their opinions thereon in writing for submission to the Council. They were desired "to correspond with the most Intelligent in all the different Counties of the Nation concerning their different ways of managing their Grounds that what may be amiss may be corrected and what is profitable imitated."

The members of the Society were recommended to form Small Societies of Gentlemen and Farmers in their several Counties, and they were invited to ask for the opinion or advice of the Council on the treatment of their Farms or Grounds.

One of the first decisions made by the Council was that it would be useful and for the service of the country that proper "Rules and Directions for fallowing of Ground, sowing Grass Seeds, Flax, and Hemp and for dressing and preparing these fibres for Manufacture, should be published"; and a Committee was named to that end.

To the gentlemen who were to prepare and put in writing their thoughts upon the different subjects, the eminently wise suggestion was made "that they should use a familiar Stile such as Country Farmers might easily understand : and that they might make the Directions in the most circumstantial Manner they could devise . . . with a particular regard all alongst to the different Soils where Directions must vary."

In pursuance of this resolution a book dealing with the subject aforementioned was prepared and issued by order of the Society, and apparently all the copies were quickly sold.

These references may serve to indicate the methods adopted by the Society of Improvers to attain their objects. They collected information about the best practice in farming and they used all the available means of distributing that information throughout the country. Landowners and farmers were invited to submit problems of land management or of animal husbandry : these were considered by the appropriate Committees, whose findings were reviewed by the Council ; and the considered findings were in due course communicated to the inquirers, free of expense except for postage. Where advice was given, it was recommended to the recipients that they should return to the Secretary a particular account of the results obtained, and this was immediately to be inserted in the newspapers "to certiorate all concerned."

Many of these cases are fully reported in the *Select Transactions*, and others are noted in a later publication of the Secretary—*The Practical Husbandman.*

The subjects dealt with were many and varied. They included such diverse matters as the treatment of soils—light, dry, barren, and stubborn, and of moss, bog-land and heath ; the use of whins for cattle feed ; the methods of planting potatoes ; the application of lime ; directions for fattening cattle; the pickling of wheat against smut ; the grafting of apple-trees ; preserving eggs ; killing rats ; making potash ; instructions for distilling and rectifying *aqua vitae* ; and several methods of preparing drams by infusion of various ingredients into brandy, rum, or *aqua vitae.*

It is hardly surprising to find that many of the requests for advice relate to low-lying meadow land, marshy, boggy ground, and moss ; or to moors, heath land and dry, stony uplands covered often with whins. Moss especially receives a good deal of attention, and there is in particular a memorial from the Secretary of the Society to the Duke of Queensberry and Dover, setting forth in considerable detail a plan of treatment for the reclamation of Lochar Moss—a problem which has been under consideration again in recent years and which still awaits solution. In the early years of the eighteenth century, wide areas in Scotland, which are now in cultivation, were in little better than their natural wild and rough state ; and much of the strenuous work of improvement was carried through under the stimulus and with the advice and help of the Society and its members.

Much attention is likewise given to the newer crops—grasses and clovers grown from seed, and turnips and potatoes. Thus, detailed instructions are given for drilling and horse-hoeing turnips which are recommended as preferable to the broadcasting and hand-hoeing which were common on the first introduction of the turnip as a field crop; and Lord Stair is quoted as being one of the first to practise drilling and horse-hoeing both in Galloway and in Lothian with the result of obtaining a much greater weight of crop.

Quite an interesting disquisition on the potato is contributed by the Secretary of the Society, showing that it was little known in Scotland as a field crop in the early years of the eighteenth century. Directions are given for growing it on the lazy-bed system, as also for planting it in drills ; the question of whole or cut "seed" is discussed, preference being given to the cut, and advice is also offered on storing the tubers over winter. The writer is enthusiastic about the potato, like the turnip, taking the place of fallow. "By this Potatoe-husbandry the husbandman gets a good crop above ground, an exceeding good one under it, and the ground improven as much as if it had lien summer-fallow, bearing no crop."

He also notes with pardonable self-satisfaction that in the very first season after the publication of his paper, more potatoes were planted in the neighbourhood of Edinburgh than had ever been set there before.

Of the personnel of the Society, the President and the Secretary are the most noteworthy. The Preses was Mr Thomas Hope of Rankeilor, advocate, to whose energy and enthusiasm in the advancement of agriculture much of the original impulse that gave rise to the Society was due, and much also of the vigour and persistence of its work in the earlier years of its existence. He had travelled abroad in France, Flanders, Holland and other European countries, and had carefully studied methods of agriculture in these lands and also in England, and he spent time and energy in passing on to others the knowledge he had gained, and in indicating the public and private advantages to be derived from improved practice. Moreover, as a practical exposition of the principles he advocated, he took from the City of Edinburgh a lease of the morass called Straiton's Loch, drained it, cultivated it, planted trees and hedges, and so made out of a sodden waste, rich meadows and pleasant walks which became the favourite resort of the ladies and gentlemen of the City.

Allan Ramsay, in his "Address to Lord Provost George Drummond and the Council of Edinburgh," thus describes this beneficent work:

Most wisely did our City move
When Hope, who judges well and nice
Was chosen fittest to improve,
From rushy tufts, the pleasing grove
From bogs, a rising paradise.
Since earth's foundations to the present day
The beauteous plain in mud neglected lay.

Now evenly planted, hedged, and drained,
Its verdure pleases scent and sight,
And here the fair may walk unpained
Her flowing silks and shoes unstained
Round the green circus of delight
Which shall by ripening time still sweeter grow
And Hope be famed while Scotsmen draw the bow.

This ground, called after its improver—Hope Park, lies at the eastern end of the Meadows, and the Society often met there, so that "having the pleasant Prospect and the encouraging Precedent in view the Zeal of the Members in the promotion of Agriculture might be the more excited."

It may be noted too that on part of the bog reclaimed then or later, Scotsmen—the Royal Company of Archers—still "draw the bow."

The Secretary of the Society was an even more enthusiastic evangelist of progress than the Preses. He was Robert Maxwell, eldest son of James Maxwell of Arkland, Kirkpatrick-Durham, Kirkcudbrightshire. In the same year in which the Society was founded, 1723, Maxwell took, on a lease of four periods of nineteen years, the farm of Cliftonhall, near Edinburgh. The area was 130 acres, all arable, and the rent, paid in money, was £50. There he became a persistent experimenter, and he probably did more than any other man to make known to his countrymen the new crops and the new methods of cultivation. Besides carrying out assiduously his duties as Secretary of the Society, he acted as adviser to many landed proprietors and supervised improvements on their estates.

In 1739 he put before the Society for the Propagation of Christian Knowledge in Scotland a proposal that that Society should allocate a portion of their funds to meeting part of the expenditure on his own experimental work at Cliftonhall. In return he undertook to publish the results of the experiments for the benefit of the farming community and to submit accurate accounts of his expenses and returns. He offered also to take boys under his care at Cliftonhall and to train them in the principles and practice of agriculture. His application was supported by the Society of Improvers, who recommended that the Christian Knowledge Society should either advance on loan to Maxwell a sum of at least £200 for five years without interest, or should pay him a grant of £30 a year for the same period. They also recommended that a fee of £3 a year should be paid to him for the maintenance of each farm pupil the Society might place with him, he to teach them root and herbage husbandry, both by the plough and by the spade; the growing and treatment of flax; the use of roots in the feeding of sheep, swine, and black cattle; and also the management of "those useful and profitable creatures, the Bees."

The Committee of the Christian Knowledge Society were pleased to approve of the proposals, but apparently there were difficulties in the way of putting them into actual operation, and, to the manifest chagrin of Maxwell, nothing came of them.

He appears to have been hurt in his personal feelings too by not being awarded a premium offered in 1756 by the Edinburgh Society for Encouragement of Arts, Sciences, Manufactures and Agriculture. The premium was offered to the person "who shall frame the best articles on which a lease of land may be extended whereby the ground may be laboured to the advantage of the Tenant without prejudice to the Master"—or landlord.

In his submission, Maxwell recommended that prior to signing a lease proprietor and farmer should have the farm surveyed by a competent agricultural expert who should plan out the cultivation and treatment of each field. The plan would form the basis of the lease and both landlord and tenant would know what their contract meant. The lease should include provisions for the carrying out of inclosing, draining, levelling, and fallowing definite portions of the ground yearly until all should be overtaken, and should enforce a specified rotation of crops and manurial treatment. All this would, he argued, be of advantage to the tenant and would in no sense prejudice the landlord, but rather the contrary.

In spite of the excellence of the paper sent in by Maxwell, under the pseudonym of "Agricola," the Society awarded the premium to John Swinton, Esq., younger of Swinton, advocate; and Maxwell feeling aggrieved, was assuredly justified in demanding that Swinton's paper should be published. Whether it ever was issued I have not been able to discover.

Another project which Maxwell pressed persistently for many years was the institution of a Professorship in Agriculture at Edinburgh University, indeed, at all Universities. "The Crown," he says, "names Professors and gives them salaries. Which of them can be more useful to the Publick than a Professor of Agriculture might be, or a General Inspector of Improvements who should be obliged to report annually the Husbandry of each County that Errors might be known and rectified?"

This proposal was strongly backed by the Society of Improvers, and one cannot help jalousing that both the members of the Society and Maxwell himself would have been ready to indicate without hesitation a suitable nominee for the post of Professor or that of General Inspector. But apparently the time was not ripe, and Maxwell had to content himself—" without the patronage of any public body and encouraged by individuals only "—with giving a course of lectures on Agriculture, in Edinburgh in the year 1756. These lectures were probably the first of the kind in Britain ; they were attended by many of the farmers and landowners in the district ; and two of them are published in the *Practical Husbandman*, which was issued in 1757, and which is a sort of second edition and supplement to the *Select Transactions*.

Previous to this Maxwell had had to surrender his lease of Cliftonhall. His public activities and his restless experimentation interfered with the business side of his farming, and although he succeeded to his father's estate of Arkland in 1745 he became bankrupt in 1749 and the estate had to be sold for £10,304 Scots. Thereafter he gained a precarious living as a land valuer, adviser, and supervisor of improvements ; and his wife is believed to have eked out the family income by keeping a shop on the north side of the Lawnmarket, between James's and Wardrop's Closes, Edinburgh. He died at the home of his son-in-law in Renfrew on 17th May, 1765.

Besides being responsible for the *Select Transactions* and the *Practical Husbandman*, he probably had a large share in the writing and editing of the "Treatise on Fallowing," etc., mentioned above, and in 1747 he published the *Practical Beemaster*, which was reprinted in John Reid's *Scots Gardiner*, in 1756.

### The Buchan Society

Of the subsidiary Societies that came into being under the auspices of the parent body, one deserves special notice. " A Small Society of Farmers in Buchan " was formed in 1730, and its early activities were distinguished by the issue in 1735 of an essay called " A True Method of Treating Light Hazely Ground, or an Exact Relation of the Practice of Farmers in Buchan, containing Rules for Infields, Outfields, Haughs, and Laighs." It is essentially a compendium of the best practice in the district at the time. The preface states that the essay " contains nothing purely speculative, but a plain and genuine relation of our practice, as we have learned from tradition and our own repeated experience, put in method to ease our memories and for the instruction of beginners."

The main interest of the essay is the graphic picture it gives of the fierce struggle the old-time farmer had to wage against the weeds which constantly threatened to smother his meagre crops in the days when corn succeeded corn with no green crop or fallow intervening to clean the ground. Repeated harrowing, grazing down the weeds by young nolt, even beating down wild oats with a sharp-toothed hook fixed at the end of a pole, were all practised in this unequal struggle to give the meagre corn crop on the infield a chance to survive and perhaps to produce two or three times the amount of seed sown. Rules are given for breaking in the outfield ; folding sheep for manure ; fauching or turning up the deeper soil " to extort by violence whatever productive qualities Providence has bestowed upon it."

Truly the Buchan farmer of those days won his bread in the sweat of his brow.

# THE STEM EELWORM DISEASE OF OATS AND ITS CONTROL

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One of the most persistent and widespread diseases of oats in Scotland is that caused by the Stem Eelworm, *Anguillulina dipsaci* (*Kühn*, 1857). The extent of its incidence is not known chiefly because the disease is frequently confused with other unhealthy oat conditions such as those caused by wireworm, frit-fly, oat-sickness and drought. Eelworm disease is popularly known as " tulip-root " or " segging." It is unfortunate that the word " segging " is applied both to oats from oat-sick soil and to eelworm-diseased oats, because the two diseases have little in common. As applied to eelworm-diseased oats, the word " segging " would appear to mean " sedging " from the sedge-like or tufted appearance of the leaves, but as used in reference to oats from oat-sick soil it refers to the drooping or sagging nature of the leaves. Similar names for dissimilar diseases must necessarily lead to confusion, and the object of this paper is to present a true picture of the nature and symptoms of eelworm disease of oats in order to avoid any possible mistake in its diagnosis. The biology of the parasite is also described, together with experiments on its control.

**Economic Importance.**—The economic importance of eelworm disease is probably higher to-day than it has ever been. In many cases barley has given place in the rotation to oats, and nothing could be less favourable to the oats or more favourable to the eelworms than too frequent recurrence of the crop. Many farmers have had to give up growing oats on certain fields, because only 2 qrs. of oats could be harvested instead of 9 qrs. In a recent case before the Scottish Land Court a tenant claimed a new valuation on the ground that his farm was so badly eelworm infested that he could not carry on under the existing rent. This is the first case of its kind in the history of Scottish agriculture where a new valuation has been applied for on the grounds of excessive damage due to eelworm.

**Predisposing Causes.**—The stem eelworm is present to a small extent in all arable soils on which oats are grown, but only by growing oats too often in the same field can the numbers multiply to such an extent as to result in excessive damage. The stem eelworm is a highly specialised parasite and although it is capable of living on more than 200 host plants, the writer has never found it attacking any crop in the North of Scotland except oats and beans. An attack on beans has been recorded only once, in a field of silage where the oats suffered severe damage. The explanation for this unusual occurrence is to be found in the fact that biologic races of eelworm may exist under certain conditions.

It has been demonstrated that less specialised strains of the stem eelworm may occur, which are capable of living on more than one host. Unspecialised strains, however, are very rare and after considering all the available evidence, one is forced to conclude that, in the North of Scotland at least, the stem eelworm is highly specialised to live on the oat plant and will eventually die out in the absence of this plant.

A consideration of these observations gives the answer to the question why eelworm has become so troublesome on several of our finest oat-growing farms. The following is a rotation practised on many Kincardineshire farms, especially smallholdings, which usually leads to a heavy eelworm infestation of the oat crop: (1) turnips and potatoes, (2) oats and wheat, (3) hay, (4) oats and wheat.

It will be observed that oats are appearing every second year. Under this system the eelworm population of the soil cannot fail to increase.

Here is another rotation, frequently practised in Aberdeenshire: (1) oats, (2) hay, (3) grass, (4) oats, (5) silage, with oats. This rotation must eventually lead to an even higher eelworm population as oats are appearing on the same ground in three successive years.

**Symptoms of Eelworm Disease.**—A characteristic feature of eelworm disease is that infected plants may be beyond recovery when only slight symptoms of disease are apparent. Germination takes place normally, and it is not until about six to seven weeks later that any abnormality of growth can be detected. The first symptom consists of a swelling of the base of the stem which gradually increases throughout the growing season. The leaves, although bright green in colour, assume a stiff or rigid appearance and are slightly thicker to the touch than those of a healthy plant.

At this stage heavily infested seedlings may wither and die, especially those which have germinated near the soil surface. Others may survive and produce tillers which seldom develop normally; they usually become markedly swollen and distorted and remain in a twisted condition beneath the soil level (fig. 1). The leaves at the junction of the roots and stem continue to enlarge,

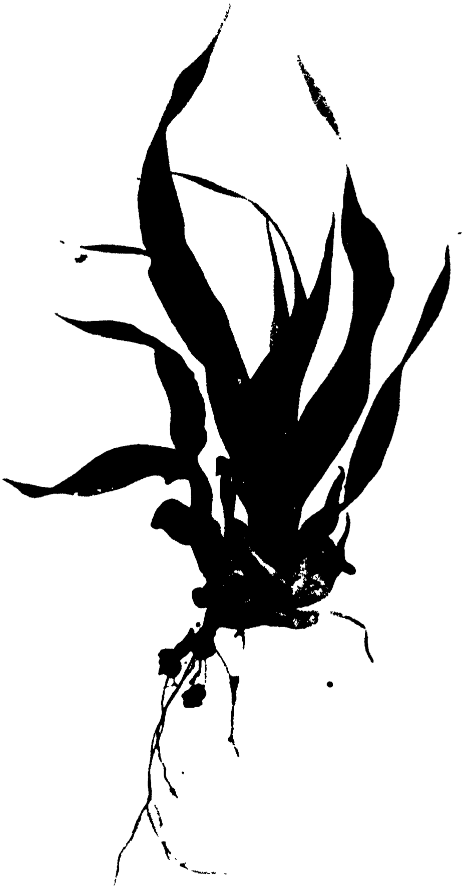

FIG. 1.—A typical example of an eelworm-diseased oat plant. Note the twisted nature of the leaves and shoots and the poorly developed root system.

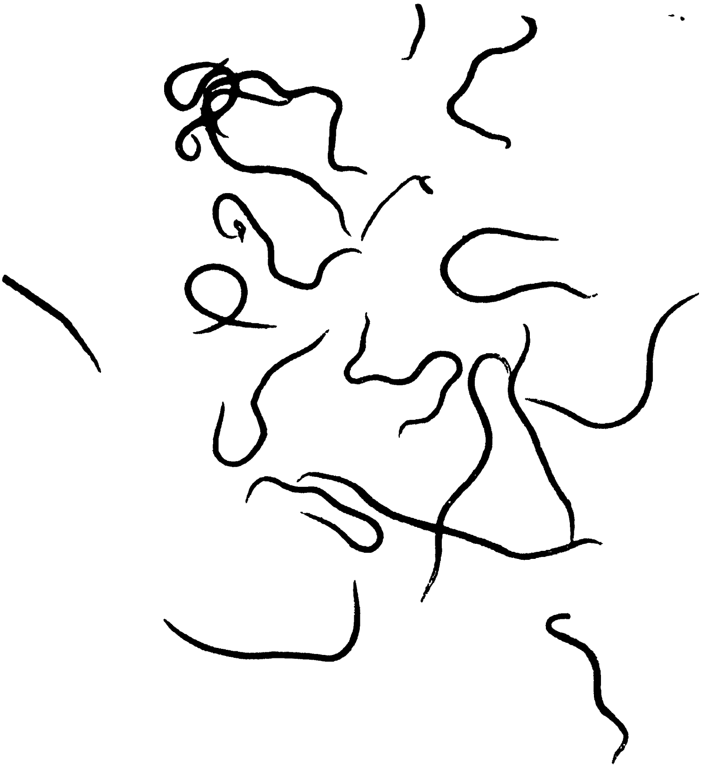

FIG. 2.—Eelworms as they appear under the microscope on teasing out the stem of an eelworm-diseased oat plant (25 times natural size).

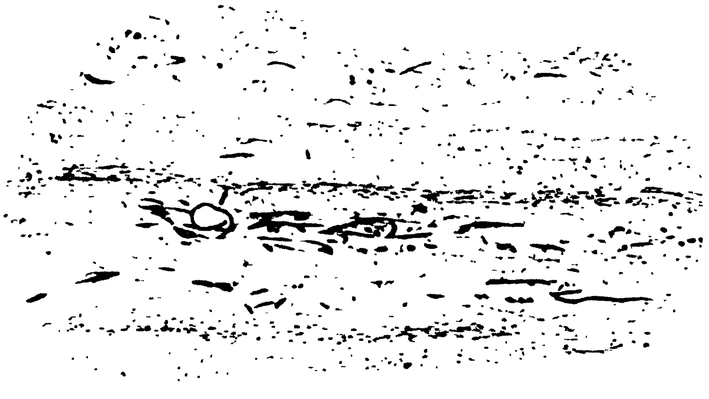

FIG. 3.—A photo-micrograph showing the soft tissue cells of an oat leaf destroyed by the invading eelworms.

giving the plant that "tulip-root" appearance so characteristic of the disease. This symptom alone will distinguish an eelworm-infected oat plant from one attacked by any other animal or fungus pest. An oat plant attacked by a wireworm or frit-fly, or any disease, never shows a thickening of the leaves at the base of the stem and the root system is intact. A final test can be made by teasing out a portion of the swollen base of the plant in water under the microscope and observing the eelworms (fig. 2).

Towards harvest, eelworm-diseased areas present symptoms not unlike those suffering from leatherjacket or wireworm attack, namely, thinness and uneven ripening. Plants which have survived the infestation are late in maturing, so that an eelworm patch is shown up by its greenish appearance. A closer inspection will reveal several stunted plants with an almost ripe panicle of oats partly emerged from the sheathing leaves. Some of the grains in these panicles will be more or less normal, others merely seconds, but the conclusive evidence is that if carefully examined in water under a dissecting microscope a number of them will yield eelworms curled up in a quiescent state between the chaff and the kernel. These eelworms will revive in a few minutes. This means that oats harvested from an eelworm-diseased field, if used for seed, are capable of carrying infection to a healthy field.

A sample of eelworm-infected seed presents no external differences from healthy seed. Only an expert with the aid of a microscope can say whether the seed is infested. No farmer should, therefore, sow or sell for seed, oats harvested from an infected field, but he may use them for milling or feeding to stock without risk of spreading infection.

**Description of the Parasite.**—A detailed description of the stem eelworm can be found in any textbook dealing with plant parasitic nematodes. All that need be said here is that the parasites are transparent eel-like worms, about $\frac{1}{20}$ of an inch long, and just visible to the naked eye when held up against the light in a glass of water. The mouth bears a spear or stylet which helps the worm to force its way into plant tissues. The spear is hollow and possesses a small opening at the sharp end through which liquid food is sucked in the form of cell sap. Eelworms feed entirely on the sap and are not capable of eating the tissues or solid food of any kind.

Male and female worms are found in the plant tissues together, and the females give rise to hundreds of oval-shaped eggs, which possess a thin shell, and are about $\frac{1}{300}$ part of an inch in length.

The females die after egg-laying takes place, but the infective larvæ have remarkable powers of remaining alive for long periods even in the most unfavourable conditions. For instance, the writer has revived them from infected straw which had been stored up in a dry cupboard for six years. This ability to enter into a state of quiescence in the driest of straw and seed, and revive again in the presence of moisture, is one of the most puzzling secrets in the life of an eelworm and no doubt explains the reason for their persistence, in spite of exhaustive efforts to control them.

**Life-History.**—Observations show that the parasite may enter the oat seedling as soon as the 16th day after germination when the first true leaf has emerged 2 to 4 inches from the coleoptile. Entrance from the soil is gained by direct penetration of the epidermal layer of the underground part of the stem. The pre-adult larvæ take up a position near the growing point and several eelworms may enter a seedling. Development takes place, males and females being formed, and the eggs hatch out in from 5 to 7 days. The young active larvæ move about freely in the soft tissues, often in such numbers as to cause rupture of the cells (Fig. 3). As a result of this breaking up of the plant cells, and the presence of a toxic substance secreted by the eelworms, the plant reacts in various ways forming swollen leaves, twisted shoots and canker-like outgrowths.

In from 22 to 28 days the newly hatched eelworms reach maturity and more egg-laying takes place. On account of this comparatively rapid development several generations may be produced within the year, until such time as the plant presents conditions no longer favourable to the nematode's developemnt.

Towards harvest the eelworms are forced to leave the plant because their food or cell sap is becoming scarce and the tissues hard and dry. The period of ripening, therefore, means a heavy migration of the larvæ into the soil, and a lean time for the worms since there are no more fresh plants to invade. But the larvæ make provision for this lean time by packing their food canal full of reserve food in the form of fat globules. The entrance of 5 eelworms into a plant in spring may mean the exit of 500 into the soil in autumn.

**Life in the Soil.**—How long the larvæ can remain alive in the soil in the absence of the oat plant has not yet been definitely determined. Van Slogteren (1) states that they cannot live more than 12 months. Working with a narcissus strain, Goodey (2) found similar results. Rostrup (3) on the other hand, found that the parasite could live and attack clover plants after a period of 4 years ; after 5 years the attack did not occur until the August of the following year. In an experiment (*vide* Methods of Control) carried on for six successive years on a farm in Kincardineshire, the writer obtained results which would seem to indicate that eelworms can remain alive for at least 4 years in moist soil in the absence of the oat plant.

**The Effect of Different Types of Soil.**—Little information is available regarding the effect of various types of soil on the incidence and spread of eelworm disease. Wilson (4) found in his experiments with eelworms on phloxes that the range was from a very rapid spread in moist loamy and sandy clay soils to a comparatively slow progress in dry sandy soils. Field observations in the North of Scotland indicate that eelworm disease is much more prevalent in moist heavy loams than in other soils, although severe infestations have occasionally been found in relatively dry, free loams. It is well known, of course, that eelworms can move with greater ease in a moist medium, so that wet or heavy soils are naturally more suitable for rapid movement. Locomotion is effected by rapid whip-like movements of the body against the soil particles and progress is more or less impossible unless a certain degree of moisture is present.

**Numbers of Eelworms in the Soil.**—It can be readily understood that the numbers of eelworms in the soil after harvest will depend on the degree of infestation of the previous oat crop. The higher the infestation the greater the number of eelworms migrating back into the stubble land. Samples of soil taken to a depth of 9 inches from an infected field a week after harvest yielded on an average 200 eelworms per cubic inch of soil or approximately 11,129,000,000 per acre. Investigations show that few eelworms are found at a greater depth than 6 inches, and that most of them confine their activities to the upper 2 inches.

**Effect of Frost and Heat.**—Contrary to popular belief frost has no injurious effect on eelworms. Ritzema Bos (5) showed that the larvæ could withstand a temperature of −19° C. for three-quarters of an hour without showing any discomfort. Heat, however, has a pronounced harmful effect, and it is worth noting that many tomato and bulb growers find steam sterilisation of the soil or hot-water treatment of infected bulbs the most successful method of dealing with the eelworm pest. These methods, however, are much too costly to use on a field scale.

**Methods of Control.**—The one reassuring feature in regard to the activities of the stem eelworm in the North of Scotland is that it does not, as a rule, attack any other crop. The writer has repeatedly examined wheat, barley, grasses, clovers, potatoes, and turnips, and none of these crops has shown the slightest signs of attack. It would appear that the parasite has become highly specialised to live on the oat plant, and that no other crop will apparently attract and sustain it. Hence it follows, that if any soil harbouring an oat strain of eelworm is left for a number of years free of oats, the eelworms must die of starvation. The question then arises : how soon can they be starved out ?

In order to throw some light on this question the writer commenced an experiment on an eelworm-infected field in Kincardineshire in 1926. In that year the oats, which were sown out with grass seeds suffered severe damage, the crop yielding about 2 qrs. per acre. The field was then left in grass for 6 years. During that period about 1 cwt. of soil was taken from the field each spring and put into three pots kept out in the open. Oats were sown in March and uprooted and microscopically examined in June for eelworms. In 1927 a heavy infestation occurred, scarcely a single plant escaping infection. In 1928, 30 per cent of the plants sown on the soil taken from the field that year were attacked, and in 1929 3 out of a total of 32 plants revealed eelworms in their tissues. In 1930 and 1931 no eelworms were found in any of the plants, and the field was ploughed up in the autumn and oats sown in the spring of 1932. An excellent crop of 8 qrs. per acre was harvested.

Although this experiment does not tell us exactly how long the oat eelworm can remain alive in the soil in the absence of the oat plant, it shows plainly enough that after an interval of 4 years a normal crop can be expected. But, to be on the safe side, an interval of 6 years is perhaps more desirable, especially with fields which are heavily infested.

*The one and only reliable and economic method of dealing with eelworms is to starve them out by altering the rotation, so that an interval of at least* 4 *years is allowed to take place between successive oat crops.* The use of chemicals is ineffective and expensive. The application of lime and of fertilisers such as sulphate of ammonia and nitrate of soda does not lead to a reduction of the eelworm content of the soil.

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# THE "GYROTILLER" IN SCOTLAND

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AMONGST the numerous innovations in agricultural machinery exhibited at the Highland and Agricultural Society's Annual Show at Dundee in 1933, the "Gyrotiller," manufactured by Messrs John Fowler & Co. Ltd., of Leeds, probably gave rise to the greatest amount of interest and criticism. Many humorous guesses were hazarded at the probable performance of the machine, and consequently a large number of spectators visited the scene of its first demonstration in Scotland, at Inchture, near Dundee, at the close of the Show.

Primarily designed to perform several acts of cultivation in one operation—ploughing, cultivating, harrowing, in conjunction with a thorough subsoiling—this ponderous and massive machine, which has an unladen weight of 18 tons and has been put on the market at a cost of £6,000, is essentially one which will be purchased only by contractors, landowners and very large farmers, although its value for contract work is making it appeal widely to farming circles in England.

In fact, the idea of the "Gyrotiller," *i.e.* rotary plough, was originally developed by Mr N. C. Storey with the object of cultivating sugar-cane plantations in the West Indies, the first machine being manufactured in 1927 under Storey's patents by Messrs Fowler & Co. for despatch to Cuba. In August 1932, a "Gyrotiller" was sent by the makers to Lincolnshire for demonstration and trial, and had a very favourable reception amongst farmers there. Since then over fifty machines have been placed in commission in England to meet the demand for their services. In June 1933, the first "Gyrotiller" was introduced into Scotland, and it was followed later by a second machine to the order of the same firm of contractors.

**The "Gyrotiller."**—The machine is a self-contained unit mounted at the rear through double steel coil springs on two sets of tracks and at the front on a single-wheel fore-carriage. The power unit consists of a M.A.N. heavy duty type, six cylinder, four-stroke, Diesel engine with a continuous rating of 170 brake horse-power. The motor supplies power for propelling the machine, operating the rotary-ploughs and auxiliary gear. The electrical equipment consists of a powerful electric starting motor, battery, dynamo and lamps for road transport and night cultivations. One man can control the whole unit.

Power is transmitted from the motor through a multiple dry plate clutch to the gear-box and thence through steering clutches to each track, and by double-roller chains and bevel gearing to the twin rings carrying the rotary tillers at the rear. Steering is effected by means of the tracks; each track is driven and controlled by separate multiple disc clutches inside the gear-box and by independent brakes working on the outer drum of each clutch. The drive to either track can be disengaged and the track held stationery by the brake while the other track is driven round it for quick turning; the fore-carriage steering-wheel is operated by engine-power. The power transmission is totally enclosed to protect it from mud, sand, dust, etc., inseparable from field work.

The gear-box provides four forward speeds, 0·7, 1·0, 1·37, and 1·95 miles per hour; two reverse speeds, 0·6 and 1·5 miles per hour, and two speeds for the rotary tillers. The fineness or coarseness of the tilth produced is to a great extent controllable by varying the ratio of the speed of the tillers to the linear speed of the machine as well as by varying the number of cutters carried by the rotary rings. The two highest forward speeds are used mainly when the machine is travelling on the roads.

The twin power-driven tiller rings are carried on a hinged framework at the rear of the main frame. The cutters can cultivate at a pre-arranged depth down to 18 inches. They are lifted from the soil by power-operated lifting gear when turning and when travelling along roads. Each ring rotates in a forward and outward direction and has three to six cutters bolted to it. Cutters of different shapes are available to produce soil inversion to a greater or less degree. The tiller rings rotate in an almost horizontal plane, and are arranged to cut more deeply at the rear than in front, so that the process of cultivation is carried out in two stages. The width of cultivation is 10 feet 6 inches to 11 feet, and the rate varies between ¾ of an acre and 1½ acres per hour.

Of the total 18 tons unladen weight of the machine, the greater proportion is carried on the tracks and spread proportionately over the total area of contact with the ground. Since the total cultivating width is greater than the overall width of the tracks, the tillers effectively obliterate any impressions left on the ground by the passage of the tracks over it. The position of the driver's platform is well fitted for controlling the machine and observing the work done.

Messrs Fowler & Co. Ltd. have placed two smaller units on the market embodying the same cultivating principles—one has an 80 horse-power motor and the other a 30 horse-power motor.

**Cultural Operations.**—The "Gyrotiller" is a complete ploughing, cultivating, harrowing and subsoiling machine in one. The existence of a large reserve of power with suitable soil conditions makes it possible to carry out other cultivating operations simultaneously with rotary tillage. Harrows, ridgers, rollers, mole drain plough or ditching plough can be attached at the rear of the tiller wheels and raised and lowered with them. Practically no time is wasted in preparing the machine before cultivations begin in a field, providing there is an entrance sufficiently wide to let it in and, when once started, the ground is cultivated continuously in strips.

Usually if it is used for autumn cultivating it leaves the surface open and rough; for spring cultivations it leaves a finer tilth for the subsequent drilling of the seed. The speed of the cutters through the soil is always several times greater than the forward speed of the machine, and hence the soil and subsoil are effectively broken up and aerated. The design of the cutters determines mainly whether the soil and subsoil will be stirred in layers or mixed together in varying degrees. Free movement of soil water and root penetration have been retarded by the existence of hard subsoil pans lying immediately below the soil. These pans have probably been formed as a result of continued shallow ploughing, and their aeration should prove to be a real cultural improvement lasting for a number of years. Where a suitable clay subsoil exists, drainage may be improved on heavy clay land by drawing a mole drain about three inches below the cultivated depth. The greatest attraction from the average farmer's point of view is the thorough aeration of the soil to greater depths than have hitherto been possible by means of ordinary farm implements.

**Areas of Operation in Scotland.**—Since their introduction the two "Gyrotillers" have cultivated approximately 1000 acres in Scotland. One machine operated in Perthshire, Angus and the Laurencekirk district of Kincardine, and the other in East Lothian. In the former area larger acreages were in general cultivated than in the latter. The strong clay lands of the Carse of Gowrie proved to be a very suitable medium for testing the performance of the "Gyrotiller" and several farmers took advantage of the occasion to break up new land which had been uncultivated for a large number of years. In East Lothian a noticeably large number of boulders occurred near the surface, and occasionally cutters were broken owing to the soft iron bolts which held the cutters to the rings failing to shear. Most of the "Gyrotilled" land was put down to wheat, sugar beet, potatoes, turnips and various market garden crops. In East Lothian small areas were cultivated to test the advantages of this sytem of rotary cultivation, and although it was obviously uneconomic to cultivate a few acres on farms considerable distances apart, probably such a policy was considered to have good advertising value. However, the poor response to the enterprise of the promoters compelled them to despatch both machines to England in the early summer of 1934.

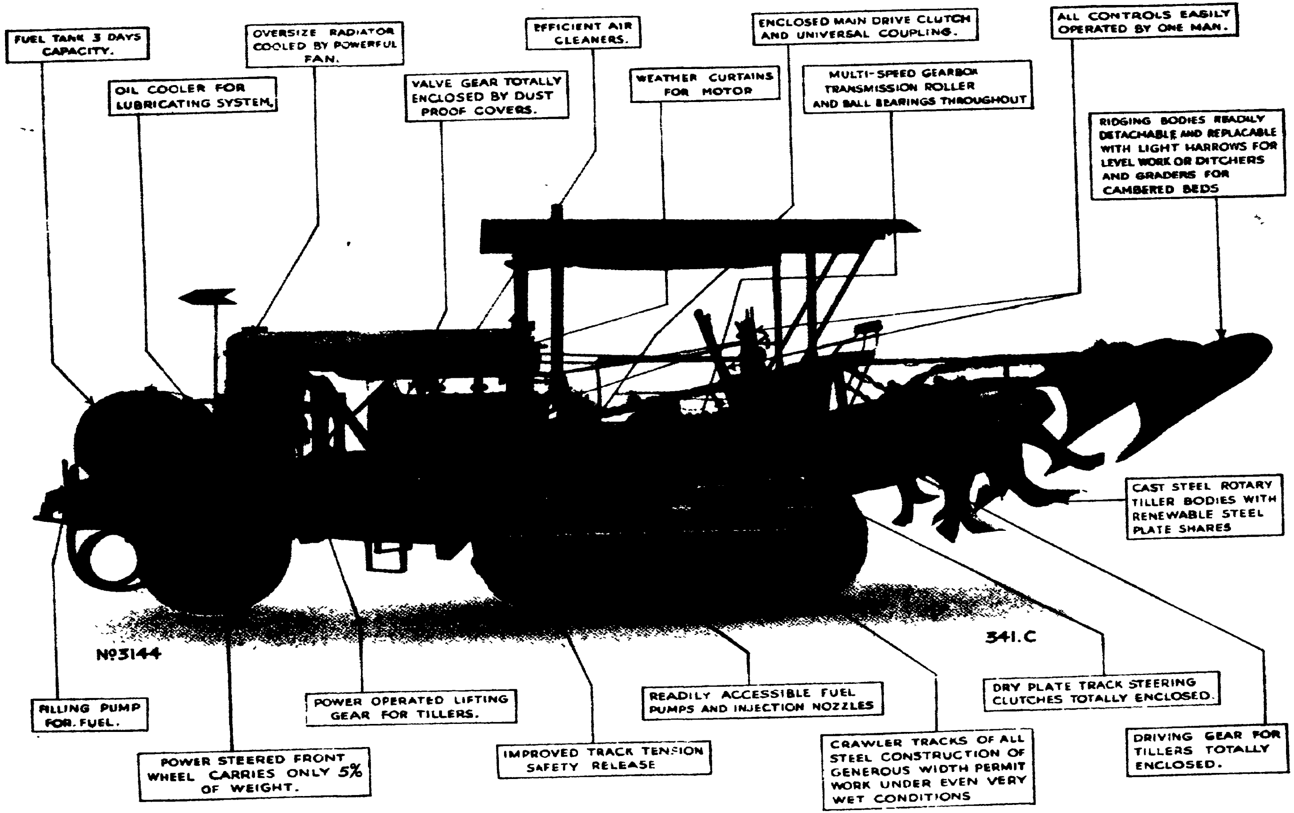
**Cost of Operations.**—The contract price for "Gyrotilling" varied with the tilth desired and the nature of the land. Thirty-three shillings per acre was approximately the average price charged, higher prices being quoted for cultivating lea and for cross-ploughing than for stubble or redland, although but little differentiation was made in the prices stipulated per acre whether the acreage was large or small. When cross-ploughing was done, the approximate charge was 52s. per acre.

**Farmers' Comments.**—The opinions of farmers who have given gyrotillage a practical trial varied as to the results of the system, but, on the whole, judgment was favourable. Certainly, a number of farmers qualify its value with certain reservations, although their experience of it is naturally limited.

For instance, in a number of cases, there was considerable evidence that the subsoil was being brought to the surface, though the resulting crop on such soil was no worse than crops harvested on adjacent soil which had been cultivated by conventional methods. Again, in several cases the tilth has been so fine that subsequent horse cultivations become difficult. When a close-textured subsoil lies beneath the cultivated soil, the upper soil may have a greatly increased capacity for holding moisture and it may have been difficult to obtain a reasonably dry seed bed after considerable rain precipitation. Furthermore, in several cases a noticeable ridging of the land occurred due to the use of the machine, and this could only have been levelled off by an implement of the road-grader type pulled behind the tillers. The camber-surfaced strips reduced the effect of subsequent rolling. One or two men pointed out that when old lea on clay was cultivated, the turf was usually left in large clods on the surface and considerable expense was incurred in breaking it down or carting it off. As might perhaps have been expected, the use of the machine to root out raspberry canes did not prove successful, since a large proportion of the uprooted canes were subsequently buried by the tillers and the operation had to be carried out again with the usual method. One case was recorded where the soil ran together again, forming a hard crust which subsequently had to be broken down again to prepare a seed bed.

On the other hand, several farmers are emphatically of the opinion that gyrotillage resulted in increased crop yields, especially of wheat and roots, and in the latter case the crop showed a noticeable improvement in both quality and form. Moreover, there is equally clear evidence that in several cases this sytem of thorough and deep cultivation had a very beneficial effect on the drainage. Quite a number of men, however, having no previous experience of any kind to serve as a basis of comparison, preferred to reserve judgment altogether on its merits and demerits.

**Conclusion.**—Although it may be too early yet to assess the advantages of gyrotillage in Scotland, it is evident that, under certain soil conditions, rotary ploughing to depths of 14 to 18 inches has undoubtedly proved beneficial not only in the increased yield and quality of crops, but also in the general health of the soil. The production of a deep finished tilth in one operation on the stiffer soils at a cost of 33s. per acre is, on the face of it, a very attractive proposition. Certainly, the cost of the operation represents a clear outlay in cash over and above the cost of maintenance of the usual complement of horses and tractors of the farm ; so that it would, presumably, be undertaken only where these were already working to capacity and, further, where the benefits of a thorough and deep cultivation were particularly desirable. There is no doubt that the residual effects of this are considerable and enduring. Developments in England indicate that the "Gyrotiller" fills a long-felt want there, and its services are much in demand. But it seems that in Scotland its merits have not yet been fully appreciated.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DRIVING GEAR FOR TILLERS TOTALLY ENCLOSED.

THE FOWLER DIESEL GYROTILLER
(STOREY'S PATENTS).

# SEED TESTING AND PLANT REGISTRATION STATION

## PART I—SEED TESTING STATION

*Report for the period from 1st August 1933 till 31st July 1934*

THE number of samples of seeds of which analyses were made during the period was 8,414, approximately 100 below average. Of this total 6,918 were tested at the instance of traders, 218 were submitted by consumers, 752 were tested for the purposes of official control, 208 in connection with the Department's own purchases and the remainder, 536, for the information of the Station and other general purposes.

### STATISTICAL RESULTS, 1933-4

GRASSES

| Variety | Number of samples | Purity | | | Germination | | | Percentage number of samples | | | Prescribed percentage standard of germination |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Highest % | Lowest % | Average % | Highest % | Lowest % | Average % | containing 2% or more of injurious weed seeds | below prescribed standard of purity (98%) | below prescribed standard of germination | |
| Perennial Ryegrass | 790 | 99·9 | 71·3 | 98·1 | 99 | 17 | 90 | 3·9 | 22·4 | 16·6 | 85 |
| Italian Ryegrass | 404 | 99·9 | 81·1 | 98·7 | 99 | 38 | 91 | 3·0 | 10·6 | 7·9 | 80 |
| Mixture—Perennial and Italian Ryegrass | 23 | 99·4 | 80·3 | 95·3 | 96 | 18 | 78 | 23·8 | 47·6 | 36·4 | 82 |
| Meadow Fescue | 95 | 99·8 | 94·8 | 98·7 | 99 | 20 | 90 | .. | .. | .. | .. |
| Cocksfoot | 557 | 99·4 | 68·4 | 90·8 | 99 | 50 | 93 | .. | .. | .. | .. |
| Timothy | 357 | 99·9 | 92·3 | 98·9 | 99 | 10 | 93 | .. | .. | .. | .. |
| Dogstail | 54 | 99·9 | 64·9 | 97·7 | 98 | 58 | 94 | .. | .. | .. | .. |
| Tall Oatgrass | 17 | 97·2 | 85·3 | 92·4 | 95 | 73 | 86 | 5·9 | .. | .. | .. |
| Meadow Foxtail | 18 | 75·1 | 62·0 | 68·9 | 78 | 50 | 67 | .. | .. | .. | .. |
| Rough Stalked Meadow Grass | 96 | 99·1 | 89·3 | 95·0 | 96 | 78 | 89 | .. | .. | .. | .. |
| Smooth Stalked Meadow Grass | 21 | 98·6 | 81·0 | 91·3 | 96 | 70 | 88 | .. | .. | .. | .. |
| Hard Fescue | 54 | 98·6 | 91·0 | 94·9 | 97 | 74 | 89 | .. | .. | .. | .. |
| Tall Fescue | 43 | 99·2 | 93·5 | 96·9 | 96 | 29 | 87 | .. | .. | .. | .. |
| Agrostis | 33 | 99·8 | 85·5 | 97·1 | 98 | 75 | 93 | .. | .. | .. | .. |
| Fine-leaved Fescue | 11 | 93·0 | 69·7 | 82·3 | 84 | 49 | 67 | .. | .. | .. | .. |
| Chewings Fescue | 26 | 99·8 | 97·5 | 99·0 | 98 | 24 | 88 | .. | .. | .. | .. |
| Red Fescue | 6 | 98·5 | 87·4 | 94·3 | 92 | 77 | 85 | .. | .. | .. | .. |
| Poa nemoralis | 4 | 87·2 | 79·9 | 84·2 | 84 | 59 | 77 | .. | .. | .. | .. |
| Holcus | 29 | 96·9 | 23·9 | 55·1 | 95 | 77 | 90 | .. | .. | .. | .. |
| Mixed Poas | 3 | 65·3 | 56·4 | 60·9 | 98 | 96 | 97 | 100 | .. | .. | .. |

Perennial ryegrass — home-grown — was of exceptionally high quality. The supply was barely sufficient for home demand and the customary export and was supplemented by imports from New Zealand.

Italian ryegrass was also of excellent quality in respect of condition, purity and germination. Imports were made from Denmark and from New Zealand in substitution for the usual import from France which had no seed to export. Imported stocks from New Zealand which were tested in trial lines in the field proved to be greatly inferior to the commercial stocks of Irish and Danish seed.

Meadow Fescue.—A feature of the trade in this seed was the presence of American seed representing approximately half of the supplies, the other half being Danish.

Cocksfoot.—The majority of supplies were of Danish origin. Samples of Swedish parcels were also received and a few of English origin. The latter were reputed to be of the late New Zealand (Akaroa) type. Field trials of samples of English-grown Akaroa Cocksfoot sown in 1933 have shown that only an occasional sample of this description conforms to the Akaroa type.

Timothy was of average quality. There was a good supply of Scots seed. Rather more than half of the samples represented importations from America and the Baltic countries.

## STATISTICAL RESULTS, 1933-4

### CLOVERS

| VARIETY | Number of samples | PURITY | | | GERMINATION | | | Percentage number of samples containing | |
|---|---|---|---|---|---|---|---|---|---|
| | | Highest % | Lowest % | Average % | Highest % | Lowest % | Average % | 1 % or more of injurious weed seeds | 2 % or more of Suckling Clover |
| Red Clover . . | 840 | 99·9 | 87·8 | 98·1 | 99+0 | 18+ 1 | 0+ 5 | 0·6 | .. |
| White Clover . | 291 | 99·8 | 86·9 | 97·8 | 99+1 | 37+ 0 | 90+ 5 | 1·2 | 2·7 |
| Wild White Clover | 407 | 99·9 | 43·6 | 97·4 | 98+2 | 16+ 6 | 85+11 | 0·8 | 4·1 |
| Alsyke Clover . | 224 | 99·6 | 86·8 | 97·1 | 98+2 | 58+ 5 | 91+ 4 | .. | .. |
| Alsyke and White Clover . . | 24 | 99·2 | 90·0 | 97·4 | 98+0 | 70+ 9 | 91+ 3 | 4·2 | .. |
| Trefoil . . | 58 | 99·9 | 97·9 | 99·5 | 94+2 | 77+ 0 | 88+ 4 | .. | .. |
| Kidney Vetch . | 17 | 94·8 | 88·6 | 92·1 | 96+0 | 76+18 | 85+ 8 | .. | .. |

Red Clover.—There was a good supply of English-grown Red Clover of very high quality for home consumption with a margin for export. European countries were buyers. As a consequence imports of American Mammoth and Canadian Red Clover seed showed increases. The stocks of the latter type exhibited considerable infestation with the clover Chalcid fly, *Bruchophagus funebris*. Thirty-eight per cent of the samples purported to be of the Late-flowering type, mainly of English origin, but with Swedish stocks well represented.

White Clover.—Samples of White Clover were almost entirely from imported stocks from Poland and New Zealand. The quality was average.

Wild White Clover was an excellent and abundant seed crop in 1933, of superlative quality. Of the 407 samples submitted all except three were obviously genuine. Only eight samples submitted represented stocks certified by the Ministry of Agriculture and Fisheries. Forty-three type samples of certified stocks, however, were received from the Seed Testing Station, Cambridge, and these have been sown for purposes of observation and demonstration. Included in this field demonstration are seven samples of certified regional stocks which have been distributed to various centres in England and Scotland for the purposes of a comparative test in pasture.

Other leguminous seeds of pasture and fodder species call for no comment.

## STATISTICAL RESULTS, 1933-4

### CEREALS

| VARIETY | Number of samples | PURITY | | | GERMINATION | | | Prescribed percentage standard of germination | Number of samples below prescribed standard |
|---|---|---|---|---|---|---|---|---|---|
| | | % Highest | % Lowest | % Average | % Highest | % Lowest | % Average | | % |
| Oats . | 1187 | 100 | 94·1 | 99·8 | 100 | 41 | 98 | 85 | 0·6 |
| Wheat . | 651 | 99·9 | 89·2 | 98·1 | 100 | 1 | 97 | 90 | 3·2 |
| Barley . | 298 | 100 | 87·7 | 98·9 | 100 | 45 | 95 | 90 | 9·7 |
| Rye . . | 20 | 99·9 | 91·4 | 98·7 | 99 | 61 | 92 | 80 | 5·0 |

Cereals.—In general the quality of cereal samples was excellent, with the exception of barley samples.

Changes in economic circumstances have been reflected in the large increase (150 per cent on the previous annual average) in the numbers of samples of wheat submitted during the past two seasons, and in the increase (66 per cent) in the numbers of samples of barley during the season under review. There is a compensating reduction of 33 per cent in the numbers of samples of oats received for test.

Oats.—The principal varieties submitted for test were Potato, Yielder, Victory, next in order of importance being Marvellous, Star, Sandy and Black Tartarian.

*Avena strigosa* (Bristle-pointed Oat) occurred as an impurity in 75 per cent of samples of Black Oats, in one instance to the extent of 4 per cent, and in 20 per cent of samples of White Oats.

Wheat.—The chief varieties represented in samples were Squarehead's Master and Million, while White Victor, Wilhelmina, Little Joss, Chevalier, Yeoman, and Red Marvel were well represented.

*Ear Cockles* occurred noticeably in 4 per cent and *Bunt* in 2 per cent of the samples.

Barley.—The varieties commonly cultivated in Scotland are

Plumage Archer, Plumage, Chevallier, Spratt Archer, Gold and Common. The general quality was not so good as might have been expected, nearly 10 per cent of the samples being below the Government Standard of germination of 90 per cent.

## STATISTICAL RESULTS, 1933-4

### ROOTS AND VEGETABLES, ETC.

| VARIETY | Number of samples | AVERAGE | | NUMBER OF SAMPLES BELOW STANDARD OF | | PRESCRIBED STANDARD OF | |
|---|---|---|---|---|---|---|---|
| | | Purity | Germination | Purity | Germination | Purity | Germination |
| | | % | % | % | % | % | % |
| Turnip . . . | 403 | 99·3 | 89 | 2·5 | 8·0 | 97 | 80 |
| Swede . . . | 338 | 99·3 | 88 | . . | 11·8 | 97 | 80 |
| Rape . . . | 36 | 99·1 | 96 | . . | 2·9 | 97 | 80 |
| Cabbage and Savoy | 86 | 99·3 | 84 | . . | 9·4 | 97 | 70 |
| Kale and Borecole . | 51 | 99·1 | 87 | 5·9 | 3·9 | 97 | 70 |
| Brussels Sprouts . | 25 | 98·7 | 91 | 16·0 | . . | 97 | 70 |
| Broccoli . . | 15 | 98·2 | 84 | 13·3 | . . | 97 | 60 |
| Cauliflower . . | 34 | 99·6 | 81 | . . | . . | 97 | 60 |
| Carrot . . . | 136 | 94·4 | 72 | 4·4 | 5·2 | 90 | 50 |
| Parsnip . . . | 26 | 96·0 | 80 | 61·5 | 3·8 | 97 | 45 |
| Beet . . . | 73 | 98·5 | 75<br>clusters | 9·7 | 2·7 | 97 | 50<br>clusters |
| Mangel . . . | 75 | 98·6 | 80<br>clusters | 4·2 | 2·8 | 97 | 60<br>clusters |
| Peas—Field . . | 25 | 97·4 | 98 | 3·6 | . . | 97 | 80 |
| Peas—Garden . | 83 | 99·5 | 83 | 2·4 | 13·3 | 97 | 70 |
| Beans—Field . . | 30 | 98·2 | 96 | 10·0 | 3·3 | 97 | 90 |
| Beans—Garden . | 26 | 99·9 | 90 | . . | 7·7 | 97 | 60 |
| Vetches . . . | 40 | 98·7 | 98 | 5·0 | . . | 97 | 90 |
| Onion . . . | 89 | 99·7 | 68 | . . | 24·7 | 97 | 60 |
| Kohl Rabi . . | 1 | 99·1 | 93 | . . | . . | 97 | 70 |
| Leek . . . | 26 | 98·7 | 78 | . . | . . | . . | . . |
| Lettuce . . . | 15 | 99·3 | 81 | . . | . . | . . | . . |
| Radish . . . | 2 | 97·8 | 89 | . . | . . | . . | . . |
| Mustard . . | 4 | 99·8 | 92 | . . | . . | . . | . . |
| Burnet . . . | 4 | 78·0 | 103<br>shoots | . . | . . | . . | . . |
| Sheeps Parsley . | 6 | 97·4 | 73 | . . | . . | . . | . . |
| Parsley—Garden . | 3 | 98·9 | 42 | . . | . . | . . | . . |
| Chicory . . . | 15 | 93·5 | 87 | . . | . . | . . | . . |
| Ribgrass . . | 20 | 91·3 | 94 | . . | . . | . . | . . |
| Yarrow . . . | 2 | 93·0 | 73 | . . | . . | . . | . . |
| Spinach . . | 1 | 99·7 | 48 | . . | . . | . . | . . |

## PART II—PLANT REGISTRATION STATION

### REGISTRATION OF NEW VARIETIES OF THE POTATO

### POTATO SYNONYM COMMITTEE

The Committee recommended two varieties, which had already been under test for three years, to be carried on to a fourth year's trial along with six varieties which had been under test for two years. The Committee also recommended a second year's test in respect of 15 varieties tested for the first time in 1933.

### WART DISEASE FIELD TRIALS

*Single Tuber Tests.*

Seedlings to the number of 670 were tested. Twenty-four of these proved susceptible.

*Inter-Departmental Tests.*

Eighteen varieties received from the English and Irish Wart Disease Stations and 12 varieties distributed to these stations were included in these tests. The determinations of the three stations on these samples were in concordance.

*Laboratory Wart Disease Tests*, 1933-4.

The laboratory test has now been made a definite service. Throughout the winter the Department provide facilities for the testing in the laboratory of new seedlings with a view to determining their susceptibility to Wart Disease. At the completion of these tests reports are issued to raisers indicating the degree of infection contracted by each variety according to the following classification :—

(*a*) No trace of infection by the Wart Disease organism during test.
(*b*) Radial galls (incipient infections) present.
(*c*) Types of infection intermediate between (*b*) and (*d*) present.
(*d*) Definite warty tissue developed.

(Varieties contracting (*b*) and (*c*) types of infection are regarded for practical purposes as immune from Wart Disease.)

The maximum number of varieties accepted from any individual is 80 single-tuber tests or 20 four-tuber tests with a limit of 100 tubers in all.

The tests are carried out according to the routine method described in the last report.

The following is a statement of results of tests of seedling varieties submitted by breeders during season 1933-4 :—

| | |
|---|---|
| Number of single-tuber samples | 531 |
| Number susceptible | 148 |
| Number of four-tuber samples | 21 |
| Number susceptible | 1 |
| Number of two-tuber samples | 138 |
| Number susceptible | 70 |

*Inter-Departmental Check Varieties.*

Varieties to the number of 53 in ten-tuber sample, which were in their second year of field test, were submitted for test in accordance with the standing instructions of the Inter-departmental Committee on Wart Disease testing. Every individual tuber in these tests reacted in some degree of infection but only one variety exhibited reaction of grade (*d*). Eleven of these varieties, carried over from 1932 for confirmatory test, were submitted to a pot test in highly infective material. Only two of the varieties showed any evidence of the disease, this being expressed as radial galls on the aerial stem.

*Extraordinary Tests.*

*B* 1320. This variety was doubtfully susceptible, discrepancies having occurred in previous tests. Samples from the produce of each of 36 plants were tested independently. The results showed that the majority of the plants, and the variety as a whole, exhibited a range of reactions between grade (*b*) and grade (*d*).

A similar range of reactions was shown by the varieties Arran Victory and Witchhill in samples of 50 tubers. In samples of this size the varieties Majestic, Golden Wonder and Bishop exhibited a range of reactions in grades (*b*) and (*c*), while Great Scot reacted consistently in grade (*b*).

*Registration Tests.*

Varieties submitted for the first time for registration numbered 55. Nine of these varieties proved highly susceptible. The determination was confirmed in field test. The remainder reacted in grades (*b*) and (*c*).

The fact that a range of reactions is obtained when a considerable series of representatives of a variety is subjected to test shows the technique of routine testing to be somewhat imperfect. A single tuber test is obviously insufficient to detect even high susceptibility. In a comparison of laboratory tests of single tubers and of field tests of single plants corresponding, the following discrepancies have appeared during the seasons 1933 and 1934 :—

| | 1933 | 1934 |
|---|---|---|
| Number of varieties common to both tests . . . . . | 380 | 264 |
| Number agreeing . . . . | 355 | 255 |

In these two years the laboratory test failed to detect susceptibility other than in incipient degree on 20 samples which exhibited Wart Disease on the corresponding plants in the field, while the field test failed to detect susceptibility on 14 samples which showed a reaction of grade (*d*) in the laboratory.

Where the degree of susceptibility under ideal field conditions is such as to cause a variety to contract definite Wart Disease, the susceptibility would be assuredly indicated by a four-tuber sample tested under laboratory conditions, but where a variety is highly resistant it may be necessary to increase the sample to 50 tubers. In actual practice this is the method employed as the four-tuber test will always indicate the necessity of testing a variety further.

## VIRUS DISEASES OF THE POTATO

### *Propagation of Unit Selections.*

An account of the work carried out under the Virus Diseases Scheme formed Part II of the Report of the Seed Testing and Plant Registration Station in this *Journal* in July 1933. By 1934, 70 stocks have been distributed throughout the country since the inception of the scheme. Many of the derivative stocks have not been granted a stock seed report in 1934 owing to the unprecedented spread of Leaf Roll during 1933 and 1934 all over the country, but especially along the East Coast, not only from field to field but also from farm to farm. As a result of the examinations in 1934, 42 additional stocks were approved as built-up stocks, and 10 stocks planted as units approved for bulking. The remaining stocks were discarded either by the growers or as a result of having received infection with virus diseases during 1933.

### *Critical Investigations.*

A synopsis of the principal results of investigations carried out under controlled greenhouse conditions and of allied investigations up to the end of May 1934 appeared in Part II of the Seed Testing and Plant Registration Station Report (*Scottish Journal of Agriculture*, July 1934). The annual conference of the Virus Diseases of Plants Committee and Workers was held at East Craigs on the 10th July 1934, when the following papers by members of the staff were read as part of the proceedings :—

| | |
|---|---|
| Types of Streak in Potatoes . . . . | A. Millar, B.Sc. |
| Notes on Top Necrosis A (Quanjer) . . . | A. Pratt, B.Sc. |
| Building Up Healthy Stocks of Potatoes. . | J. L. Harley, B.Sc. |

Material was collected from field crops during the summer for investigation and demonstration in connexion with the Department's scheme for the Inspection of Potato Crops.

### *Registration Trials of Cereals.*

The variety Early Miller Oat (No. 644, Scottish Society for Research in Plant Breeding) was approved by the Department for registration in 1933. It is an early-ripening, white-grained variety, suitable for general cultivation, and is high yielding on fertile soils. The grain is short and plump, well filled and of an attractive colour ; it is not thick in the husk, gives a high bushel weight, and, as a report from a firm of oatmeal millers shows, it gives promise of being a high-class milling oat. The straw is of good fodder quality, is of medium length, and possesses a high degree of resistance to lodging.

# Notes from Agricultural Colleges

## *Craibstone*

*Potatoes*, 1934.—A slight snowstorm with some frost at the end of February rendered the soil unsuitable for planting potatoes, and it was the middle of March before a start was made. At this time the soil temperature was rather under 40° F. Fairly frequent showers in April were sufficient to keep the soil raw, while in the second week there was heavy sleet and rain almost every day, the total rainfall for the week being about 6 inches. This again delayed planting, so that most of the maincrops were later than usual in being planted.

A long dry spell in June and the greater part of July had an adverse effect on the growth of early varieties, so that many of them ripened prematurely, with the result that there was generally a slightly less crop with a smaller proportion of ware than is usual. It should be kept in mind that the soil at Craibstone is light and consequently liable to dry up if there is a continued spell of dry weather. The same result might not follow on heavier soils. Early varieties that were later in being planted, however, did not suffer to the same extent, as they were able to benefit from rain that came later. This is well illustrated in a trial where Di Vernon was planted at fortnightly intervals from the middle of March to the beginning of May, half the seed being sprouted and half unsprouted.

EFFECT OF TIME OF PLANTING—DI VERNON

*Per Acre*

| | | Ware Over 2″ | | Seed 2″-1¼″ | | Small Under 1¼″ | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | tons | cwt. | tons | cwt. | tons | cwt. | tons | cwt. |
| March 16th. | Sprouted . | 5 | 1 | 5 | 8 | 0 | 15 | 11 | 4 |
| ,, ,, | Unsprouted | 5 | 0 | 6 | 15 | 1 | 2 | 12 | 17 |
| April 1st. | Sprouted . | 7 | 16 | 7 | 2 | 1 | 0 | 15 | 18 |
| ,, ,, | Unsprouted | 6 | 18 | 7 | 5 | 0 | 12 | 14 | 15 |
| ,, 16th. | Sprouted . | 10 | 6 | 7 | 5 | 0 | 10 | 18 | 1 |
| ,, ,, | Unsprouted | 7 | 16 | 7 | 16 | 0 | 17 | 16 | 9 |
| May 1st. | Sprouted . | 9 | 7 | 5 | 12 | 0 | 12 | 15 | 11 |
| ,, ,, | Unsprouted | 6 | 15 | 6 | 0 | 0 | 15 | 13 | 10 |

It will be seen that those planted on 16th April, both when sprouted and unsprouted, produced the heaviest crop. Although those sprouted and planted on 16th March came through the ground first, the shaws during the growing season were much less vigorous than those planted later, and they ripened off early and the crop was much less than that got from the other plantings. This poor result may have been due partly to the check received during the dry weather and partly to the temperature of the soil being under 40° F. at planting time and for a week or two later. It has been observed in previous trials that the soil temperature should be at least 40° F. at the time of planting if the best results are to be got.

In each case the plants from the sprouted seed were much earlier than from the unsprouted and, with the exception of the earliest planted, produced a heavier crop. These increases from the sprouted seed grew larger as the season advanced. They were :

| | |
|---|---|
| April 1st . . . . . . | 1 ton 3 cwt. |
| ,, 16th . . . . . | 1 ,, 12 ,, |
| May 1st . . . . . . | 2 tons 1 ,, |

and it will be seen that these increases were in the ware.

In the case of the late variety, Golden Wonder, the result was somewhat similar, except that those sprouted and planted on 1st April produced the heaviest crop, the earliest planted being slightly less while there was a gradual reduction from each subsequent planting.

The Golden Wonder being much slower in growth would not suffer to the same extent, if at all, from the dry conditions prevailing, as the rain came in good time before the plants showed any sign of suffering, and it is likely that the slightly smaller crop obtained from the sprouted seed planted on 16th March is entirely due to the rather low soil temperature checking the tender growth. The unsprouted did not suffer at all when compared with the unsprouted planted later.

EFFECT OF TIME OF PLANTING—GOLDEN WONDER

*Per Acre*

| | | | Ware Over 2″ | | Seed 2″-1½″ | | Small Under 1½″ | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | | tons | cwt. | tons | cwt. | cwt. | tons | cwt. |
| March | 16th. | Sprouted . | 6 | 5 | 8 | 12 | 10 | 15 | 7 |
| ,, | ,, | Unsprouted . | 4 | 15 | 7 | 17 | 8 | 13 | 0 |
| April | 1st. | Sprouted . | 8 | 6 | 7 | 0 | 10 | 15 | 16 |
| ,, | ,, | Unsprouted . | 4 | 13 | 7 | 3 | 8 | 12 | 4 |
| ,, | 16th. | Sprouted . | 6 | 13 | 6 | 19 | 8 | 14 | 0 |
| ,, | ,, | Unsprouted . | 4 | 16 | 5 | 12 | 6 | 10 | 14 |
| May | 1st. | Sprouted . | 6 | 10 | 6 | 10 | 6 | 13 | 6 |
| ,, | ,, | Unsprouted . | 4 | 8 | 7 | 0 | 8 | 11 | 16 |
| ,, | 16th. | Sprouted . | 5 | 14 | 5 | 16 | 6 | 11 | 16 |
| ,, | ,, | Unsprouted . | 2 | 18 | 5 | 8 | 6 | 8 | 12 |
| June | 1st. | Sprouted . | 2 | 14 | 5 | 18 | 12 | 9 | 4 |
| ,, | ,, | Unsprouted . | 1 | 1 | 5 | 1 | 18 | 7 | 0 |
| ,, | 16th. | Sprouted . | 1 | 15 | 6 | 1 | 14 | 8 | 10 |
| ,, | ,, | Unsprouted . | 0 | 8 | 4 | 8 | 16 | 5 | 12 |

As in former trials, at the height of the growing season, the shaws of those that were unsprouted and late in being planted were much taller and more vigorous looking, and the leaves were thicker, darker in colour, and healthier looking than those that were sprouted and planted early. As is seen, however, these thicker, darker, healthier looking leaves did not mean an increased crop. Further, these shaws were much more tender and broke down, so that more labour was entailed in removing them at lifting time. The shaws of the earliest plantings, whether sprouted or not, were more sturdy and did not break down at all. The largest amounts of both ware and seed were got from the early plantings.

During the last year or two several growers, especially those who grow more particularly for seed, either cut down or burn the shaws in order to stop growth, so that there may be a larger proportion of seed-sized tubers. A small trial carried out last year showed that the cutting of the shaws some time before lifting decreased the amount of ware without increasing the amount of seed.

This year the trial was carried out with Arran Pilot, Di Vernon, Majestic, and Golden Wonder. Plots of each were lifted early and at the same time the shaws on plots of each were (1) cut; (2) destroyed with copper sulphate, 5 per cent; (3) destroyed with sulphuric acid, 5 per cent; (4) left to grow to maturity. There were five plots of each treatment with each variety. The shaws on the plots treated with sulphuric acid went down almost at once and soon shrivelled up, while those treated with sulphate of copper took a few days.

The average results obtained were as follows:

### EFFECT OF CUTTING AND SPRAYING SHAWS

*A. Arran Pilot—*

| All treatments on 6th Aug. | Over 2" | | Between 2"-1½" | | Under 1½" | | Total | |
|---|---|---|---|---|---|---|---|---|
| All except 1 lifted 10th Oct. | tons | cwt. | tons | cwt. | tons | cwt. | tons | cwt. |
| 1. Crop lifted 6th Aug. | 6 | 19 | 5 | 5 | 1 | 11 | 13 | 15 |
| 2. Shaws cut . . | 7 | 18 | 5 | 14 | 1 | 1 | 14 | 13 |
| 3. Copper sulphate . | 8 | 12 | 5 | 12 | 1 | 4 | 15 | 8 |
| 4. Sulphuric acid . | 8 | 6 | 5 | 9 | 1 | 3 | 14 | 18 |
| 5. Shaws left to mature | 9 | 7 | 5 | 10 | 1 | 2 | 15 | 19 |
| *B. Di Vernon—* | | | | | | | | |
| All treatments on 23rd Aug. | | | | | | | | |
| All except 1 lifted 26th Sept. | | | | | | | | |
| 1. Crop lifted 23rd Aug. | 4 | 1 | 7 | 12 | 1 | 9 | 13 | 2 |
| 2. Shaws cut . . | 6 | 8 | 10 | 4 | 1 | 3 | 17 | 15 |
| 3. Copper sulphate . | 6 | 8 | 10 | 2 | 1 | 3 | 17 | 13 |
| 4. Sulphuric acid . | 6 | 9 | 10 | 10 | 1 | 4 | 18 | 3 |
| 5. Shaws left to mature | 7 | 2 | 10 | 6 | 1 | 6 | 18 | 14 |

*C. Majestic*—

| All treatments on 3rd Sept.<br>All except 1 lifted 12th Sept. | Over 2" | | Between 2"-1½" | | Under 1½" | | Total | |
|---|---|---|---|---|---|---|---|---|
| | tons | cwt. | tons | cwt. | tons | cwt. | tons | cwt. |
| 1. Crop lifted 3rd Sept. | 5 | 15 | 7 | 19 | 2 | 0 | 15 | 14 |
| 2. Shaws cut . . | 7 | 0 | 11 | 0 | 1 | 3 | 19 | 3 |
| 3. Copper sulphate . | 6 | 11 | 11 | 16 | 1 | 2 | 19 | 9 |
| 4. Sulphuric acid . | 7 | 3 | 11 | 10 | 0 | 18 | 19 | 11 |
| 5. Shaws left to mature | 7 | 18 | 11 | 14 | 1 | 4 | 20 | 16 |

*D. Golden Wonder*—

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| All treatments on 17th Sept.<br>All except 1 lifted 31st Oct. | | | | | | | | |
| 1. Crop lifted 17th Sept. | 2 | 15 | 6 | 17 | 2 | 3 | 11 | 15 |
| 2. Shaws cut . . | 3 | 10 | 8 | 5 | 1 | 15 | 13 | 10 |
| 3. Copper sulphate . | 4 | 0 | 7 | 12 | 1 | 13 | 13 | 5 |
| 4. Sulphuric acid . | 4 | 2 | 7 | 2 | 1 | 8 | 12 | 12 |
| 5. Shaws left to mature | 4 | 5 | 8 | 3 | 1 | 12 | 14 | 0 |

An examination of the results shows (1) that in all cases there is a smaller crop of both ware and seed-sized tubers and a larger amount of chats when the crop is lifted early ; (2) that the crop continued to grow after the treatments were made ; (3) that there is comparatively little difference between the crops obtained from the different methods of cutting and spraying ; (4) that none of the treatments has increased the amount of seed-sized tubers ; and (5) that there is the largest amount of ware when the crop is allowed to ripen.

It may be supposed that destroying the shaws would be effective against blight, but as there was none on the tubers of any of the varieties no information could be got on this point.

The combined effect of a number of different conditions was tried with Majestic. Large (6 oz.) and small (2 oz.) setts of this variety were planted at 9 and 12 inches apart in drills 26 and 29 inches wide. The following table summarises the results :

*A. Drills* 26 *inches wide*—

| | | Over 2" | | Between 2"-1½" | | Under 1½" | | Total | | Less seed planted | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | tons | cwt. | tons | cwt. | tons | cwt. | tons | cwt. | tons | cwt. |
| Large | 9 in. | 7 | 4 | 11 | 0 | 1 | 4 | 19 | 8 | 15 | 10 |
| ,, | 12 ,, | 9 | 2 | 8 | 14 | 1 | 0 | 18 | 16 | 15 | 16 |
| Small | 9 ,, | 8 | 12 | 6 | 4 | 0 | 9 | 15 | 5 | 13 | 19 |
| ,, | 12 ,, | 9 | 16 | 5 | 13 | 0 | 6 | 15 | 15 | 14 | 15 |

*B. Drills* 29 *inches wide*—

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Large | 9 in. | 6 | 11 | 10 | 4 | 1 | 0 | 17 | 15 | 14 | 6 |
| ,, | 12 ,, | 6 | 13 | 10 | 0 | 0 | 15 | 17 | 8 | 14 | 14 |
| Small | 9 ,, | 9 | 11 | 5 | 16 | 0 | 11 | 15 | 18 | 14 | 15 |
| ,, | 12 ,, | 9 | 7 | 5 | 0 | 0 | 9 | 14 | 16 | 13 | 18 |

So far as the total crop is concerned, the large seed produced distinctly heavier crops than the small seed. After deducting the amount of seed planted, the large setts planted in 26-inch drills are best, while there is comparatively little difference between the others.

The large seed produced a much heavier crop of seed-sized tubers and also chats than the small seed, which, however, produced most ware. As one would expect, there is also most seed and chats and least ware from the 9-inch spacing.

A trial to test the effect of cutting large setts (6 oz.) of Golden Wonder into two and three parts respectively and planting them at 12, 18, and 24 inches apart was made, three plots of each being planted. The results obtained were as follows :

EFFECT OF CUTTING SEED—GOLDEN WONDER

*Per Acre*

| | Over 2" | | Between 2"-1¼" | | Under 1¼" | Total | | Less seed planted | |
|---|---|---|---|---|---|---|---|---|---|
| | tons | cwt. | tons | cwt. | cwt. | tons | cwt. | tons | cwt. |
| *Whole Setts—* | | | | | | | | | |
| 12 in. . | 3 | 19 | 9 | 16 | 6 | 14 | 1 | 11 | 1 |
| 18 ,, . | 3 | 18 | 8 | 14 | 8 | 13 | 0 | 11 | 0 |
| 24 ,, . | 4 | 19 | 7 | 18 | 6 | 13 | 3 | 11 | 13 |
| *Cut in Two—* | | | | | | | | | |
| 12 in. . | 4 | 1 | 8 | 6 | 6 | 12 | 13 | 11 | 13 |
| 18 ,, . | 4 | 14 | 7 | 10 | 4 | 12 | 8 | 11 | 8 |
| 24 ,, . | 4 | 17 | 6 | 17 | 6 | 12 | 0 | 11 | 5 |
| *Cut in Three—* | | | | | | | | | |
| 12 in. . | 4 | 14 | 7 | 10 | 4 | 12 | 8 | 11 | 8 |
| 18 ,, . | 5 | 7 | 6 | 4 | 3 | 11 | 14 | 11 | 1 |
| 24 ,, . | 5 | 12 | 5 | 7 | 4 | 11 | 3 | 10 | 13 |

The whole seed produced fully a better crop than that cut in two, which was in its turn fully better than that cut in three. In every case except one the closest planting was best and the widest was the poorest. When, however, the amount of seed planted is deducted (it varied from 3 tons with the whole seed planted at 12 inches to 10 cwt. per acre with that cut in three planted at 24 inches), there is practically no difference between any of the crops. The differences are pronounced and consistent, however, in the amounts of ware and seed-sized tubers. The larger the setts and the closer the planting the greater is the amount of seed-sized tubers, whereas the smaller the setts and the wider the planting the greater the amount of ware.

## *The West of Scotland Agricultural College*

*Oat Variety Trials.* — During the season of 1934 yield and maturity trials of some of the most outstanding oats were carried out at Auchincruive. The varieties included in the trial were :—

1. Victory.
2. Star.
3. Crown.
4. Early Miller.
5. Bell.
6. Yielder.
7. Record.
8. Pure Line Potato.
9. Elder.

The experimental area was a good light loam and was uniformly manured with the following dressing of artificial manures per acre :—

1 cwt. Sulphate of Ammonia.
1 cwt. Potash Salts (30 per cent).
1½ cwt. Superphosphate (16 per cent).
½ cwt. Mineral Phosphate (27 per cent).

The oat crop was taken after swedes. The crop was drilled in on 30th March 1934, and the seeding was at the rate of 2,500,000 seeds per acre. The seed, prior to drilling, was all dressed with a seed disinfectant.

During the growing season, there was no marked differences and the order of ripening was as follows :—

1. Bell.
2. Yielder.
3. Early Miller.
4. Victory.
5. Star.
6. Crown.
7. Pure Line Potato.
8. Record.
9. Elder.

The period of ripening was spread over about 14 days.

The season was a very testing one for strength of straw and differences as undernoted were observed :—

Yielder, Record and Elder had no lodging, Star very slight, considerable lodging in Victory, Early Miller and Bell, and extensive lodging was present in Crown and Pure Line Potato.

The yields of grain and straw, expressed in percentages—taking Victory which gave 35½ cwt. grain and 51 cwt. straw per acre as 100—were as follows :—

| Variety | Grain | Straw |
|---|---|---|
| Victory | 100 | 100 |
| Star | 107 | 96 |
| Crown | 94 | 92 |
| Early Miller | 105 | 97 |
| Bell | 74 | 81 |
| Yielder | 94 | 81 |
| Record | 94 | 81 |
| Pure Line Potato | 69 | 84 |
| Elder | 87 | 91 |

*Farmyard Manure.*—Because of scarcity of information on the relative manurial values of specific types of farmyard manure (especially poultry dung), an experiment was designed and laid down in spring 1934 to obtain data on this subject.

Separate supplies of the following types of manure were preserved :—

1. Poultry.
2. Dairy Cow.
3. Horse.
4. Pig.
5. Bullock.

The rate of application per acre of manures (2) to (5) adopted was 16½ tons. Existing data indicating that the manurial value of poultry manure is about 2½ times that of ordinary farmyard manure, an arbitrary dressing of 6 and 3/5ths tons per acre of the former was applied. In each case the manure was applied as nearly as possible fresh, and the opening of the 28-inch drills, application of dung, planting and closing were all carried out on 3rd May. No artificial manures were applied. The experiment was laid down in duplicate, each plot being 1/12th acre.

During the earlier part of the growing season, the potatoes which had received pig and dairy cow manure appeared distinctly greener and more virile while there was a gradual tailing off in this respect in the order; poultry, horse, bullock, and no treatment. Later in the season, the pig manure and the bullock manure appeared to be the best.

The potatoes were lifted on 10th October and the following results obtained :—

| Treatment | Weight per Acre | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ware | | Seed | | Brock | | Total | |
| | ton | cwt. | ton | cwt. | ton | cwt. | ton | cwt. |
| Poultry | 3 | 15 | 3 | 3 | 1 | 9 | 8 | 7 |
| Dairy Cow | 2 | 19 | 3 | 5 | 3 | 2 | 9 | 6 |
| Horse | 3 | 3 | 3 | 4 | 1 | 14 | 8 | 1 |
| Pig | 3 | 7 | 3 | 14 | 1 | 9 | 8 | 10 |
| Bullock | 3 | 6 | 3 | 18 | 1 | 10 | 8 | 14 |
| No treatment | 2 | 15 | 3 | 3 | 1 | 6 | 8 | 14 |

The investigation is being continued.

## General Assembly of the International Institute of Agriculture

The twelfth General Assembly of the International Institute of Agriculture was held in Rome from 22nd to 27th October 1934. The British delegation comprised the Right Hon. Earl De La Warr (Head of the Delegation), Messrs R. R. Enfield and R. C. Hinton of the Ministry of Agriculture and Fisheries, Mr E. M. H. Lloyd, Secretary to the Market Supply Committee, Messrs Charles Weatherill, C.B.E., and J. M. Ramsay, O.B.E., of the Department of Agriculture for Scotland, and Mr D. A. E. Harkness of the Ministry of Agriculture, Northern Ireland.

Several changes had occurred since the eleventh Assembly was held. Prince Ludovico Spada Potenziani had succeeded M. de Michelis as President of the Institute, and the United States and other countries had returned to active participation in its work.

M. Massé (France), was appointed President of the Assembly, and Mr Tugwell (U.S.A.) and Lord De La Warr, Vice-Presidents.

The most important business before the Assembly was a motion presented on behalf of the Permanent Committee by Dr H. C. Taylor, the representative of the United States on that body, to the effect that, with a view to meeting more fully the need for statistical and economic information that has arisen from recent developments in agricultural policy throughout the world, the Institute's work in this direction should be extended and improved.

The United States Government had placed on the agenda for discussion the subject of " Trade Barriers, Commercial Treaties and Long-Time Planning," which was introduced by Mr Rexford Tugwell, Under Secretary of Agriculture and Head of the United States delegation. While no motion was made on this subject, it afforded an opportunity for the delegates of various countries to make statements regarding the agricultural policy of their Governments. Lord De La Warr's exposition of British policy obviously excited much interest among the members of the Assembly.

This discussion prepared the way for the consideration of Dr Taylor's motion, the principle of which was accepted on all hands, and was strongly supported by the British and other Imperial delegations. The resolution, as finally adopted, was made more definite by the insertion of a request that the Permanent Committee should as soon as possible draw up, and circulate to the Governments of the adhering States, a list of the additional particulars that the Institute will require in order properly to discharge its extended duties as an international source of statistical and economic information regarding agriculture.

Another resolution, which may be regarded as complementary to that just mentioned, draws attention to the need for reconsidering the work of the " Scientific Bureau " of the Institute (which deals with technical matters relating to the science and practice of agriculture), with a view to its concentration on matters of real international significance.

The position of the World Census of Agriculture, which was discussed at the Assembly of 1932, was again under consideration, and it was agreed that the publication of the results of the Census, on a more modest scale than that originally contemplated, should be completed by the year 1936.

The financial position of the Institute has considerably improved during the last two years, owing partly to the reformed methods of accounting and control introduced in 1932, and partly to increased receipts in the form of payment of arrears by certain countries, and a further improvement is expected to take place. The official resolution places a limit of 4,500,000 liras (about £50,000 at par of exchange) on expenditure during each of the years 1935 and 1936, subject to the provision that half of any income beyond that amount may be spent in addition.

The salaries and other conditions of service of the Institute's staff have for several years been the subject of much discussion. A scheme of revised salaries presented by the Permanent Committee was adopted as an interim measure, with the proviso that the Permanent Committee should explore the whole question in consultation with representatives of the staff—an innovation strongly supported by the British and other Imperial delegations. There was a general feeling that advantage should as soon as possible be taken of the improved financial position to raise the general level of salaries, which was lowered in 1931 under the stress of the urgent need for economy, and which in any case compares unfavourably with the scales adopted by other important international institutions.

Finally, a resolution was adopted on the subject of the diplomatic status of the Institute as an international body, of its officials and of the delegates to the General Assembly, since the Italian law of June 1930 on this subject requires clarification and more precise application in certain ways.

The proceedings of the Assembly were carried on in a harmonious spirit and with a large measure of agreement on the important proposals embodied in the resolutions, which promise well for the future usefulness of the Institute.

## Fourth Report on the Profitableness of Farming in Scotland, 1931-2

THE Department have now issued their fourth report on the economic position of agriculture in Scotland. This is based on a study of the financial accounts from 198 farms which have been collected by the Advisory Economists at the Agricultural Colleges and which serve as a basis for advisory work as well as for the assessment of the national situation of the industry.

The report follows the lines of those previously issued, but it is perhaps advisable to repeat the warning that, until the groups of farms dealt with can be fitted into a framework in which each type and each size of enterprise can be given its appropriate weight, less significance should be attached to the actual figures than to their general effect, less weight given to their absolute amounts than to the comparisons which they afford as between one type of farming and another and between one period and another. Nevertheless, the work gains in value with each additional statement, both on account of its gradually widening scope and because comparisons are thereby made possible over an ever lengthening period.

The general position in the north-east shows some improvement over 1930-1, with the exception of the cattle-rearing and feeding farms. Of the 72 farmers in this area 39 (or 54 per cent) made a profit as distinct from a loss; 28 (or 39 per cent) might have been able to live on their earnings without drawing on capital; but only 19 (or 26 per cent) could have been satisfied that they had obtained a reasonable return for both their capital and their labour and management (*i.e.* labour income).

In the east an improvement in the fortunes of the suburban and cropping farmers has not been shared by the arable-stock farmers. Taking a broad view, however, of the 27 farmers concerned, 20 (or 74 per cent) gained a profit; 17 (or 63 per cent) may have been able to live on their earnings; but only 11 (or 41 per cent) could have had reason to be satisfied that they had achieved a return of 4 per cent on their capital and a reasonable labour income.

The main weight of the depression was, however, experienced in the Borders. The position of these farms was bad in the previous year but in 1931-2 only one farm, out of the 23 included, succeeded in showing a profit. This area may have been later than some of the others in experiencing the full weight of the depression, but the result is no less serious on that account.

In the south-west, while the cheese farms and semi-urban dairy farms did somewhat better, the average profit on the general milk-selling farms is considerably less than in the previous year. Of the 54 farms included 46 (or 85 per cent) showed a profit; 35 (or 65 per cent) may have provided a living for the farm household; but only 28 (or 52 per cent) had a satisfactory labour income after allowing for a return of 4 per cent on capital. As it is, however, this is a considerably better position than that shown in any of the other three areas.

Taking only those farms for which records are available for the two consecutive years, out of a total of 111, 57 improved their position in 1931-2 as compared with 1930-1, while 54 suffered reverses. On balance, the farms in the north-east and east fared better, while those in the south-west, and particularly in the Borders, fared worse.

Financial exigencies have necessitated a change in the format of the report which is now cyclo-styled. Copies, which should be of value to county organisers and teachers in agricultural colleges as well as to farmers, factors, landowners, and others concerned with the state of the agricultural industry, may be obtained from H.M. Stationery Office, 120 George Street, Edinburgh, price 1s. 4½d. post free.

# Review

*The Journal of the Orkney Agricultural Discussion Society* (Vol. IX).

Orkney might claim from the agricultural point of view to be a miniature Denmark since its farmers, like the farmers of that country, have for long been amongst the most progressive in the matter of co-operation, development of the poultry industry and the general application of science to agriculture. Evidence of their enterprise is again furnished in the *Annual Journal of the Orkney Agricultural Discussion Society* for the year 1934.

From its birth some nine years ago this Discussion Society has been fortunate in having as its Secretary the local College Organiser. At the end of each session a *résumé* of the various papers given by the members of the Society is published in the form of a Journal. Mr Allan, B.Sc.(Agr.), who now holds the combined posts of Secretary of the Society and the Editor of the *Journal*, is to be congratulated on the publication of this issue. It contains many interesting and valuable articles and, in addition, space is found for such information regarding feeding stuffs and manures, etc., as may be considered indispensable to the up-to-date farmer.

The *Journal* opens with an excellent article on "Common Lamenesses in the Horse," by Mr Matthew White, M.R.C.V.S.

Another paper describes "The Pig that is Wanted," from the bacon curer's point of view. Mr Horne, whose opinions in the matter are set forth in a very readable article, is a bacon curer in Kirkwall.

No programme of the Discussion Society in Orkney could be complete without reference to the poultry industry. Hitherto that industry has concentrated on egg production. Miss Grant, the instructress, who gives a paper on "Poultry for Table Purposes," indicates how advances along that line may well be made.

The versatility of the *Journal* is well exemplified by the nature of the other papers which embrace discussions on the economics and management of small-holdings, the Aberdeen Angus *versus* the Shorthorn, cultivation practices, reconstruction of farm buildings, internal combustion engines, etc. An excellent account of the Agricultural Credits (Scotland) Acts, 1929, is given in the form of a dialogue between a prospective borrower and his banker. In this way many difficult points are made clear.

Statistics at the end of the *Journal* indicate that Orkney, during the period 1932-33, increased its hen population from 392 birds per 100 acres arable to 423, a figure about three times that of most of the other Scottish counties.

This *Journal*, which is remarkable value for the price of one shilling, enjoys a wide popularity, not only in Orkney and Shetland, but also in some of the mainland counties. It may be had, post free, from the Secretary, Agricultural College Office, Kirkwall, for the sum of 1s. 3d.

## Labour on Scottish Farms

The Agricultural Returns collected on 4th June 1934, give the following numbers of workers employed on that date on holdings exceeding one acre in extent. The occupiers of holdings, their wives, and domestic servants are excluded, but other members of the occupiers' families are included.

| | Regular Workers | Casual Workers |
|---|---|---|
| Males, 21 years and over | 59,166 | 6,829 |
| Males under 21 years | 19,567 | 2,995 |
| Total | 78,733 | 9,824 |
| Women and girls | 18,537 | 6,180 |
| Total | 97,270 | 16,004 |
| Grand total | 113,274 | |

The grand total is 809 above that recorded in 1933, regular workers are more by 1,207, but casual workers have decreased by 398. Of the regular workers men over 21 have increased by 138 or 0·2 per cent, and males under 21 by 339 or 1·8 per cent. Women and girls regularly employed have increased by 730; male casual workers are fewer by 963, but female casual workers are more numerous by 565.

Although the number of regular workers is greater than in the preceding year, it is considerably less than in 1921, the year when annual returns of labour began to be made. Men over 21 are more numerous by 354, while the number of those under 21 has diminished by 3,720, and women and girls by 3,235. All classes of casual workers show lesser numbers employed, the total in 1934 being fewer than in 1921 by 7,023.

## Acreage under each Variety of Potatoes in 1934

A statement is printed on pages 76-78, showing the acreage under certain varieties of potatoes in Scotland in 1934, as returned by growers of one acre or over. These returns cover 122,932 acres out of the total acreage of 139,998 acres, the difference as in previous years being chiefly accounted for by the total exclusion of certain districts in the Highlands and Western Islands, and by the exclusion of holdings on which less than one acre is grown. The total acreage shows a decrease, as compared with 1933, of 12,515 acres, and the acreage included in the returns of varieties is less by 810 acres.

The area under First Earlies, 16,578 acres, shows a decrease of 1,322 acres or 7·4 per cent from the preceding year. Epicure, with 9,021 acres or 738 acres less than last year, accounts for 54·4 per cent of the total as against 54·5 per cent of the total in 1933.

Eclipse takes second place this year with 2,161 acres, but is a smaller acreage by 222 acres or 9·3 per cent than in the previous year. Of the remaining thirteen varieties specified as First Earlies seven show decreased acreages.

Second Earlies, with a total of 14,605 acres, is less than last year's total by 587 acres. Great Scot, with an increase of 486 acres, covers 9,296 acres or 63·6 per cent of the total area under Second Earlies, as against 58·0 per cent last year. British Queen, with a decrease of 531 acres and a total of 3,363 acres, accounts for a further 23·0 per cent of the total acreage. The areas under Arran Luxury, Catriona and Edzell Blue show increases, but decreases are recorded in the acreages of the remaining five specified varieties.

The area under Maincrops, 91,749 acres, shows a decrease of 9,796 acres. Kerr's Pink, with 41,486 acres, has decreased by 15,253 acres or 26·9 per cent, but retains first place, accounting for 45·2 per cent of the whole area. King Edward VII is again second with 61,489 acres, 2,301 acres more than in the preceding year. Majestic and Golden Wonder, with 14,011 acres and 9,080 acres respectively, are the varieties showing the next largest acreages. The variety Arran Banner, with 2,843 acres, shows an increase of 1,048 acres or 58·4 per cent. Doon Star with an area of 724 acres shows an increase of 508 acres, while Dunbar Cavalier, which recorded a considerable increase last year, is less by 1,316 acres or 66·8 per cent. The acreages in some of the other varieties show fluctuation, but the areas under the crop are relatively small.

Varieties immune from wart disease cover in all 83,267 acres or 67·7 per cent of the total area classified.; non-immune varieties cover 39,087 acres or 31·8 per cent, while the varieties not specified in the statement account for only 578 acres.

STATEMENT showing the Acreage under each variety of Potatoes in Scotland in 1934.

A. *First Earlies*

| | VARIETY | ACRES |
|---|---|---|
| 1. | *Arran Crest† | 54 |
| 2. | *Arran Pilot† | 270 |
| 3. | *Ballydoon | 210 |
| 4. | *Dargill Early | 42 |
| 5. | *Di Vernon | 89 |
| 6. | *Herald† | 38 |
| 7. | *Immune Ashleaf | 38 |
| 8. | *Snowdrop (including Witch Hill) | 70 |
| 9. | Beauty of Hebron (including Puritan) | 93 |
| 10. | Duke of York (including Midlothian Early and Victory) | 1,977 |
| | Carry forward | 2,881 |

| | Variety | Acres |
|---|---|---|
| | Brought forward | 2,881 |
| 11. | Eclipse (including Sir John Llewelyn) | 2,161 |
| 12. | Epicure | 9,021 |
| 13. | May Queen | 200 |
| 14. | Ninetyfold | 323 |
| 15. | Sharpe's Express | 1,893 |
| 16. | Other First Earlies not specified above | 99 |
| | Total | 16,578 |

B. *Second Earlies*

| | Variety | Acres |
|---|---|---|
| 17. | *Ally | 281 |
| 18. | *Arran Comrade | 229 |
| 19. | *Arran Luxury | 168 |
| 20. | *Ben Lomond | 225 |
| 21. | *Catriona | 159 |
| 22. | *Edzell Blue | 332 |
| 23. | *Great Scot | 9,296 |
| 24. | *King George V | 191 |
| 25. | British Queen (including Pioneer, Macpherson, Maid of Auchterarder, etc.) | 3,363 |
| 26. | Royal Kidney (including Queen Mary) | 210 |
| 27. | Other Second Earlies not specified above | 151 |
| | Total | 14,605 |

C. *Maincrops*

| | Variety | Acres |
|---|---|---|
| 28. | *Sutton's Abundance (including Culdees Castle, Kerr's New White, Twentieth Century, Just in Time, etc.) | 584 |
| 29. | *Arran Banner† | 2,843 |
| 30. | *Arran Consul† | 1,014 |
| 31. | *Arran Victory | 300 |
| 32. | *Bishop | 66 |
| 33. | *Champion | 320 |
| 34. | *Doon Star | 724 |
| 35. | *Dunbar Cavalier | 655 |
| 36. | *Golden Wonder (including Peacemaker) | 9,080 |
| 37. | *Irish Queen | 123 |
| 38. | *Kerr's Pink | 41,486 |
| 39. | *Langworthy (including Maincrop and What's Wanted) | 172 |
| 40. | *Majestic | 14,011 |
| 41. | *Rhoderick Dhu | 102 |
| 42. | *Tinwald Perfection | 95 |
| | Carry forward | 71,575 |

| | VARIETY | ACRES |
|---|---|---|
| | Brought forward | 71,575 |
| 43. | Arran Chief | 1,915 |
| 44. | Field-Marshal | 298 |
| 45. | King Edward VII (including Red King) | 16,489 |
| 46. | President (including Iron Duke and Scottish Farmer) | 59 |
| 47. | Up-to-Date (including Dalhousie, Factor, Glamis Beauty, Scottish Triumph, etc.) | 1,085 |
| 48. | Other Maincrops not specified above | 328 |
| | Total | 91,749 |
| | Total area classified | 122,932 |
| | Acreage not included | 17,066 |
| | Total acreage grown | 139,998 |

NOTES :—

1. The following districts are excluded :—In the County of Inverness : Skye, Harris, North and South Uist. In the County of Ross and Cromarty : Western, South-Western and Lewis.
2. Returns showing a total of less than one acre under potatoes are not tabulated.
3. Varieties marked thus * are immune from wart disease.
4. Varieties marked † have been registered by the Department of Agriculture for Scotland as new varieties.

## Agricultural Returns, 1934

THE Abstract of the Agricultural Returns printed on page 101 shows that the total area under all crops and grass amounts to 4,600,440 acres (a decrease of 13,268 acres as compared with 1933), the arable land being less by 38,502 acres, while the area under permanent grass has increased by 25,234 acres. Rye-grass and other rotation grasses and clover have decreased by 60,779 acres, the increase in the area under other crops being thus 22,277 acres.

The total area under the cereal crops is 1,015,206 acres, being 16,594 acres more than in 1933. The area on which wheat was grown shows an increase of 19,241 acres or 24·5 per cent. Barley shows an even greater increase of 36,442 acres or 60·9 per cent, while oats show a decrease of 39,362 acres or 4·6 per cent. The combined area under wheat, oats and barley is 1,010,372 acres, and shows an over-all increase of 16,321 acres above the area returned in 1933.

Mixed grain shows an increase of 358 acres or 20·2 per cent, but rye, beans and peas show decreases of 85 acres or 3·0 per cent, 459 acres or 15·1 per cent, and 89 acres or 14·7 per cent respectively. The area under potatoes is smaller by 12,515 acres or 8·2 per cent, while turnips and swedes show an increase of 2,291 acres or 0·7 per cent. Sugar beet shows a large increase of 5,830 acres or 341·7 per cent. Cabbage and rape show increases of 824 acres or 17·1 per cent, and 1,040 acres or 11·5 per cent respectively; while vetches, tares, etc., for fodder, show a decrease of 134 acres or 1·6 per cent. The area under flax has increased from 44 acres in 1933 to 52 acres this year.

Rye-grass and other rotation grasses and clover show a decrease of 60,779 acres or 4·1 per cent. The area for hay was greater by 2,283 acres or 0·6 per cent, but that for pasture was less by 63,062 acres or 5·8 per cent. The area under permanent grass shows an increase of 25,234 acres or 1·6 per cent, that grown for hay having increased by 1,821 acres or 1·0 per cent, and that grown for pasture by 23,413 acres or 1·7 per cent.

The returns of live stock show that horses and sheep continue to decrease in number, while cattle and pigs show increases. Horses used for agricultural purposes are fewer by 1,871 or 1·6 per cent, while unbroken horses have increased by 1,238. "Other horses" have decreased by 794 or 5·0 per cent, the net decrease of all horses being 1,427 or 1·0 per cent. All classes of dairy cattle show increases; cows in milk have increased by 4,348 or 1·2 per cent, cows in calf by 1,939 or 3·6 per cent, and heifers in calf by 6,031 or 9·2 per cent. Bulls have increased by 82 or 0·5 per cent. "Other cattle" two years old and above show a decrease of 6,866 or 3·4 per cent, while those of one year old and under two and those under one year show increases of 6,263 or 2·0 per cent, and 7,762 or 2·8 per cent respectively. The total number of cattle has thus increased by 19,559 or 1·5 per cent. The total number of sheep, 7,655,476, is 155,668 or 2·0 per cent below that of 1933. Breeding ewes are less by 31,352 or 0·9 per cent, and lambs by 111,287 or 3·3 per cent. "Other sheep" one year old and above have decreased by 14,714 or 1·6 per cent, while rams show an increase of 1,685 or 1·8 per cent. Pigs show an increase of 39,251 or 23·5 per cent. The number of sows is greater by 6,335 or 28·8 per cent, boars by 373 or 15·2 per cent, and other pigs by 32,543 or 22·8 per cent.

The acreage under rough grazings, 10,409,549 acres, is 31,105 acres or 0·3 per cent less than last year; included in this figure is the estimated area of land in deer forests used or capable of being used for grazing, which in 1934 amounted to 1,084,000 acres. The figures for cattle and sheep in Scotland include 2,195 cattle and 62,834 sheep grazing in deer forests on 4th June; of these, 1,076 cattle and 42,725 sheep were also included in returns made by agricultural occupiers. The necessary adjustments have been made so that no duplication has taken place in the statement of totals for Scotland.

The poultry figures are as follows :—

| | |
|---|---|
| Fowls over six months old . . . . . | 3,830,578 |
| Fowls under six months old . . . . . | 4,198,519 |
| Ducks over six months old . . . . . | 159,303 |
| Ducks under six months old . . . | 78,857 |
| Geese over six months old . . . . . | 9,381 |
| Geese under six months old . . . . . | 19,217 |
| Turkeys over six months old . . . | 20,854 |
| Turkeys under six months old . . . | 105,895 |
| Total . . . | 8,422,604 |

The Agricultural Returns include statistics of acreage owned by occupiers, but these particulars are not included in the printed abstract. The total area of land under crops and grass returned as owned by occupiers of holdings in 1934 amounts to 1,511,253 acres, as compared with 1,510,786 acres in 1933, an increase of 467 acres. This area is 32·9 per cent. of the whole area of land under crops and grass ; in 1933 the proportion was 32·8 per cent.

The returns of labour employed on farms are summarised on page 75.

## Agricultural Conditions in 1934

THE weather during January and the first three weeks of February was very mild ; rather high winds were fairly general throughout January and in the west and south-west moderately heavy falls of rain occurred intermittently. All classes of farm work progressed without interruption. Wintry weather set in during the last week of February and continued throughout the first three weeks of March. Conditions were wet, cold and stormy, with showers of snow and hail in many districts ; night frosts were frequently followed by piercing winds and spring growth was considerably retarded. Towards the end of the month the weather improved and much headway was made with ploughing and spring sowings. During the greater part of April the rainfall was very heavy and in many districts between the Tay and the Moray Firth severe flooding and damage to crops occurred. In parts of Angus oats had to be resown and in one or two other areas the land was too wet for seeding at the end of April. Low temperatures, ground frosts and barren winds were experienced during May and in many areas growth was retarded. In north-eastern and western districts there was a considerable rainfall, but in the central counties dry conditions were general and on some farms there was a shortage of water at the end of the month. In most districts farm work then was fairly well advanced. Bright, warm and dry weather prevailed during the first half of June ; showers fell in most districts towards the end of the month, but in the north-east severe frosts caused some damage to crops. In a few districts water supplies were low at the beginning of July. The weather during the first half of July was very favourable for haymaking and the work made excellent progress, but the lack of moisture affected crops severely in several areas. Rain fell in all districts in the latter part of July, which improved the growth of grass, but came too late to increase appreciably the bulk of straw in the grain crops, which were lodged and twisted by heavy and intermittent showers, sometimes accompanied by thunder. Broken weather prevailed throughout August but the bright sunshine and drying winds which followed the wet spells helped grain to ripen satisfactorily. The securing of hay was made rather difficult and in a few districts the quality of the crop was affected. Heavy rain squalls in September greatly retarded harvesting and at times the work was completely at a standstill; the crops lay in the stook longer than usual in several districts, and in some places leading took place when grain was in rather doubtful condition. In eastern and north-eastern counties open and fairly mild weather prevailed during the greater part of October but elsewhere wet and at times stormy weather was general. Flooding occurred in several areas and in Renfrew six inches of rain fell during the month. Cold and wet conditions set in towards the end of October and continued through the first week or ten days of November; some snow fell and frost occurred, while in the west and extreme north the rainfall was heavy. During the latter half of November the weather was open, mild and dry; arrears of outdoor work were overtaken and live stock benefited considerably.

Wheat maintained steady growth until March, when frost, cold winds and lack of moisture had an adverse effect on the crop in places. Spring sowings were practically completed before the beginning of April. Low temperatures and lack of sunshine during May retarded growth somewhat; some damage was done by insect pests, and in South-West Angus " Wheat Bulb Fly " was so prevalent that much of the crop was ploughed up, or barley was drilled in. Rain towards the end of July helped the filling of the ears and ripening was rapid. Wheat generally came to harvest a good crop. In the Lothians cutting began before the end of July and in most districts harvesting was completed by the middle of September.

The sowing of barley was practically completed by the end of April. Germination, while regular, was rather slow and at the end of May rain and heat were badly needed. Marked improvement was apparent towards the end of June, and at the end of July ears were filling well. In the eastern half of the country many fields were badly laid and twisted by heavy rains, great damage being done to several of the best fields in Roxburgh. Barley ripened well, but where the crop was heavy handling was difficult owing to lodging. Cutting was general about the third week of

August and harvest was completed about a week later than wheat. Where secured late the crop did not show so good bloom as in the previous year.

The sowing of oats was nearing completion by the end of April; in South-West Angus, however, second sowings were necessary where fields were flooded. Early-sown oats made good progress during May but the growth of those sown later was checked by cold winds. At the end of July plants were healthy, but oats did not thrive so well as the other cereals and in places average progress was not maintained. In several areas the crop was badly laid and twisted by the heavy rains in the latter half of July. In early districts in the Lothians harvest was practically completed by the end of August but harvesting operations were not general in most other districts until the third week of the month. Broken weather interfered with harvesting and heating in the stacks occurred, while damage and much discoloration of grain was caused by continued wet weather during the latter stages of securing. Where harvested early oats were a good sound crop, but on some farms in the west the harvest was not finished until November.

Weather conditions during the early summer did not adversely affect the growth of beans and at the end of July the crop had podded well and had a good length of straw. Plants ripened well and cutting had made good progress by the end of August.

In a few districts soil and weather conditions were unfavourable for the planting of potatoes but the work was generally completed during May. Maincrop varieties were slow to break through the ground, while early varieties were below the average in bulk where lifted before the end of June. Good steady progress was maintained throughout the latter part of July and August and tubers filled out well. Leaf Roll and Blight were apparent in various districts. Where harvested early the crop was pitted in satisfactory condition; but where lifting was retarded by wet weather, and in later districts, there was evidence in places of disease setting in.

Turnips and swedes suffered greatly from the dry weather conditions during the early stages of growth; second sowings were general during June, and even third and fourth sowings were carried out. Where sown early plants had a satisfactory appearance at the end of July but where sown later the appearance of the crop then was the worst for many years. Much damage was done by Turnip Fly, Rot and "Finger and Toe." In several districts the rain later in the season considerably improved the crop, but in many areas it remained far below the average both in condition and in bulk, turnips particularly being of very poor quality. Where fields were under water in October the keeping quality of swedes was badly affected.

Mangolds suffered little or no check throughout the season and grew into a sound and fairly bulky crop. During November lifting and storing made rapid progress under satisfactory conditions.

Sugar beet was sown earlier than usual on some farms and by the beginning of June the crop showed an even and healthy braird. Thinning was generally completed by the end of June. Plants maintained most satisfactory growth and the crop all over was superior to that of the previous year. Prospects of a good yield of roots held firm throughout the growing season, though damage by green fly was prevalent in South-West Angus and the Lothians. Roots generally lifted very clean and in sound condition ; when delivered at the factory the crop yielded a satisfactory sugar content.

As a result of the fine open weather that prevailed during the winter, ryegrass and clover " seeds " showed more promise than is usual at the end of February, but growth was checked by the cold conditions during April and May. Cutting began, in isolated cases, during the last few days of June. Clover appeared to be rather less abundant than usual but the mixture improved with the rain towards the end of June. Excellent harvesting weather was experienced in the first half of July, when a considerable proportion of the crop was secured and proved to be of very good quality. Thereafter harvest operations were greatly interfered with by broken weather, and in several districts the crop was spoiled to some extent. In the extreme north and west the severe weather protracted harvesting to a much later date than is usual.

About the beginning of November outdoor work was held up by the inclement weather. During the latter half of the month, however, the soil dried considerably, arrears of work were speedily overtaken and autumn cultivation generally was well advanced. Autumn sowings of wheat were, as a rule, completed about the third week of November and in most districts an even and healthy braird covered the ground at the beginning of December.

Pastures showed the effects of the dry weather in May and early June, but improved quickly with the rain towards the end of July and maintained a fresh appearance from then on. In several districts the deficiency of water supplies somewhat retarded the progress of live stock ; in Moray and Banff grass sickness among horses caused many deaths. Grazing cattle and dairy cows generally maintained good, healthy condition. Hand-feeding had at times to be given to keep up the flow of milk but the normal seasonal yields were generally maintained. Lambing was carried out under very difficult conditions and the results were most disappointing. In addition to a reduced crop of lambs many deaths occurred among ewes and lambs. In many areas ewes were thin and did not milk well, while joint-ill, wool-ball, and maggots caused trouble. Flocks, however, showed considerable improvement when the warmer weather set in and generally throve well throughout the summer and autumn.

# Annual Estimates of the Produce of Crops

The following Statement regarding the Produce of Crops for 1934 was issued on 11th December.

Preliminary Statement showing the ESTIMATED TOTAL PRODUCE and YIELD PER ACRE of Wheat, Barley, Oats, Beans, Hay, Potatoes and Roots, in SCOTLAND in the Year 1934, with COMPARISONS for 1933, and the AVERAGE YIELD PER ACRE of the Ten Years 1924-33.

| Crops | | Estimated Total Produce | | Acreage | | Average Estimated Yield per Acre | | | Average of the Ten Years 1924-1933 |
|---|---|---|---|---|---|---|---|---|---|
| | | **1934** | 1933 | **1934** | 1933 | **1934** | | 1933 | |
| Wheat . . | *Tons*<br>*Quarters* | 111,000<br>502,000 | 93,000<br>417,000 | 97,627 | 78,386 | *Cut.*<br>*Bushels* | 22·6<br>41·1 | 23·7<br>42·6 | 21·4<br>39·2 |
| Barley (including Bere) | *Tons*<br>*Quarters* | 90,000<br>462,000 | 57,000<br>298,000 | 96,250 | 59,808 | *Cut.*<br>*Bushels* | 18·6<br>38·4 | 19·1<br>39·8 | 18·1<br>37·8 |
| Oats. . . | *Tons*<br>*Quarters* | 645,000<br>4,360,000 | 694,000<br>4,648,000 | 816,495 | 855,857 | *Cut.*<br>*Bushels* | 15·8<br>42·7 | 16·2<br>43·4 | 15·6<br>42·5 |
| Beans . . | *Tons*<br>*Quarters* | 2,500<br>11,000 | 2,800<br>12,700 | 2,576 | 3,035 | *Cut.*<br>*Bushels* | 19·1<br>34·2 | 18·5<br>33·4 | 18·3<br>33·1 |
| Hay from Rotation Grass . | *Tons* | 676,000 | 623,000 | 393,780 | 391,497 | *Cut.* | 34·3 | 31·8 | 33·0 |
| Hay from Permanent Grass | *Tons* | 160,000 | 161,000 | 129.235 | 127,701 | *Cwt.* | 24·7 | 25·4 | 26·6 |
| Hay from Timothy Meadows | *Tons* | 112,000 | 110,000 | 51,499 | 51,212 | *Cwt* | 43·6 | 42·8 | 44·4 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Potatoes . | . *Tons* | 1,025,000 | 1,077,000 | 139,998 | 152,513 | *Tons* | 7·3 | 7·1 | 6·7 |
| Turnips and Swedes . | . *Tons* | 4,550,000 | 5,006,000 | 353,944 | 351,653 | *Tons* | 12·9 | 14·2 | 16·4 |
| Mangolds . | . *Tons* | 35,700 | 31,700 | 1,738 | 1,389 | *Tons* | 20·6 | 22·7 | 19·3 |
| Sugar Beet | . *Tons* | 71,800 | 15,500 | 7,536 | 1,706 | *Tons* | 9·5 | 9·1 | 7·6* |

* Average of 6 years only.

Note.—The outstanding features of the returns are the increases in the production of wheat, barley, and sugar beet. Wheat shows a total produce of 111,000 tons, which is 18,000 tons greater than in 1933, and 51,000 tons greater than in 1932. The area under the crop is greater by almost 20,000 acres than in 1933, while the average yield per acre, 22·6 cwt., is 1·1 cwt. less than last year's yield, although it exceeds the decennial average by 1·2 cwt. Barley, with a total produce of 90,000 tons, shows an increase of 33,000 tons. The area grown is greater than in 1933 by more than 36,000 acres, but the yield per acre is below that of the preceding year by 0·5 cwt., although it exceeds the decennial average by the same amount. The total production of oats is 645,000 tons, showing a decrease compared with the previous year of 49,000 tons. The area is less than in 1933 by almost 40,000 acres, while the yield per acre, 15·8 cwt., is less than last year's by 0·4 cwt., but is greater than the ten years' average by 0·2 cwt. The produce of beans, 2,500 tons, is 300 tons less than in 1933, the area under the crop, 2,576 acres, showing a decrease of 459 acres from the preceding year. The yield per acre, 19·1 cwt., is greater than that of 1933 by 0·6 cwt. and exceeds the decennial average by 0·8 cwt.

The total produce of hay of all kinds, 948,000 tons, is 54,000 tons larger than in 1933. Hay from rotation grass shows a production of 676,000 tons, which is 53,000 tons greater than last year's. The area shows an increase of 2,283 acres, while the yield per acre, 34·3 cwt., is 2·5 cwt. above the 1933 figure and 1·3 cwt. above the decennial average. Timothy meadows, with an average yield of 43·6 cwt., produced 112,000 tons or 2,000 tons more than last year, while other meadows, with an average yield of 24·7 cwt., produced 160,000 tons, a decrease of 1,000 tons compared with last year.

The total production of potatoes, 1,025,000 tons, is 52,000 tons below that of 1933, but exceeds the expectations formed earlier in the season. The area under the crop shows a decrease of 12,515 acres, but the yield per acre, 7·3 tons, is greater than last year's by 0·2 ton, and exceeds the decennial average by 0·6 ton. The total produce of turnips and swedes, 4,550,000 tons, is the smallest on record, and shows a decrease of 456,000 tons as compared with 1933. The area is greater than last year by 2,291 acres, but the yield per acre, 12·9 tons, is the lowest recorded since 1899; last year's yield was 14·2 tons and the decennial average is 16·4 tons. Mangolds, with an area increased by 349 acres, show a total production of 35,700 tons, which is greater than that of 1933 by 4,000 tons. The yield per acre, 20·6 tons, falls short of last year's record figure by 2·1 tons, but is 1·3 ton above the decennial average. The area under sugar beet is more than four times that of 1933, the respective figures being 1,706 acres in that year and 7,536 acres in 1934, while the production has increased from 15,500 tons to 71,800 tons. The yield per acre, 9·5 tons, is 0·4 ton above last year's figure and 1·9 ton above the average for the last six years.

The yields per acre of wheat, barley, oats, hay from ordinary meadows, turnips and swedes and mangolds are less than those recorded in 1933, while those of beans, hay from rotation grass and timothy meadows, potatoes and sugar beet show increases.

# Errata

## VOLUME XVII, No. 3

p. 268, line 11.—for 17 *grams* read 10 *grams*.

pp. 268–269, Table II.—each value for lysine should be divided by 1·79.

# SCIENCE AND PRACTICE

*The following extracts and summaries are supplied by members of the staffs of Scottish agricultural colleges and scientific institutions or are taken from recent bulletins of the International Institute of Agriculture. Full references to the original publications may be obtained on application to the Secretary, Department of Agriculture, York Buildings, Edinburgh.*

## CROPS AND SEEDS

**Effect on the Growth of Oats of Copper Sprays used for the Control of Mustard.** *Butler and Bissey. Jour. Amer. Soc. Agron.*, 1934, 26, 8, p. 693.—The results of four series of pot experiments indicate that oats are sensitive to a copper spray and that the injury produced persists for a longer period than is commonly believed.

**Oat Breeding in Scotland.** *William Robb. Empire Journal of Experimental Agriculture, Volume* 2, *No.* 7, *July* 1934.—Methods followed at the Scottish Plant Breeding Station are briefly described. Reference is made to the differences in the genetical constitution of several black-grained varieties in respect of grain colour, and to the mode of inheritance of striped leaves in oats. Descriptive notes are given regarding three new varieties of oats which have been put into commerce by the Scottish Society for Research in Plant Breeding.

**Zmienność i korelacje cech u ziemniaka.** (With English Summary.) (*Variability and correlations in potato.*) *Podal Jerzy Korohoda. Pamietnik Państwowego Instytutu Naukowego Gospodarstwa Wiejskiego Pulawach. Tom.* 13.—It was found that the most variable characters in the potato are the number of stems, the number of leaflet pairs, and the yield (yield of tubers and yield of starch).

Characters showing little variation are: the thickness of the tubers, the length of the stem, the breadth of the leaflets and the length of the leaflets.

Numerous correlations have been ascertained, which prove that the separate characters of the potato, both morphological and physiological, are mutually inter-related forming one whole.

A distinct positive correlation was observed between colour of seedlings and the colour of the stems, flowers and tubers. A similar positive correlation was observed between the yield of tubers and the length of the vegetative period, number of stems, length of stem, and the yield of starch.

The percentage yield of starch is distinctly positively correlated with the length of the vegetative period and the length of stem. The yield of starch, the percentage content of starch, the yield and the number of tubers from one plant are distinctly positively correlated.

**Trials with Strains of Cocksfoot and Observations on the Policy of the Station in Relation to their Distribution and Use.** *R. G. Stapledon, C.B.E., M.A. The Welsh Journal of Agriculture, Volume* 10.—Five main types and strains of cocksfoot bred at the Welsh Plant Breeding Station were subjected to sward tests. The various pedigree strains are less impeded by hay grazing than the ordinary Danish commercial which was not only the earliest to start growth in the spring, but was also more erect in growth than the pedigree strains derived from indigenous stocks.

Persistency appears to some extent to be a function of width of leaf. The narrower-leaved strains are not so palatable to stock as those with broader leaves, but the narrow-leaved strains are probably the most persistent. Size of panicle and size of seed are correlated in a general way with width of leaf, and since small seeds do not give rise to established seedlings as generously as do large seeds it was evident that persistency can be achieved at too high a price.

A striking feature of the trials was the excellent persistency of the pasture and pasture-hay strains on infertile soils and at high elevations. Erectness of growth and breadth of leaf both favouring palatability, it followed that in general, Danish cocksfoot was more palatable than the generality of indigenous strains.

Evidence has been accumulated at the Station which seems to show that cocksfoot, as a pasture grass, has not the same fatting value as perennial ryegrass.

The trials, with a number of strains of one and the same species, raised very difficult and important questions. The different strains all tend to have their special and often ultra-local applications. On the balance much could be said against the releasing of innumerable strains—no matter how excellent each may be from a special purpose point of view.

## SOILS

**The Influence of Different Dressings of Nitrogen on the Yield and Composition of Oats with Special Reference to Uptake and Utilisation of Nutrients.** *Lüdecke. Zeit. Pf. Dung. u. Bk.*,1934, A, 35, 1/2, 6.—A description is given of a series of pot experiments which was conducted over a period of three years with oats grown in sand; seven different dressings of nitrogen in the form of nitrate of soda were applied, and basal dressings of other nutrients were given to each pot. Results of the yields obtained and of the contents of the crop in the principal plant nutrients are presented and discussed.

**A Comparison of several Legumes with respect to Nitrogen Accretion.** *Lyon and Bizzell. Jour. Amer. Soc. Agron.*, 1934, 26, 8, p. 651.—Experiments have been conducted with various legumes, alone and in combination with other crops, over a period of ten years. Details are given of the nitrogen contents of the crops and the effects of the various legumes on the nitrogen content of the soil are discussed.

**The Influence of Soil Treatment upon the Composition of Sweet Clover.** *Sneider and Hein. Jour. Amer. Soc. Agron.*, 1934, 26, 9, p. 740.—Samples of sweet clover (*Melilotus Alba*) have been taken from field experiment plots which had been treated with lime, phosphorus and potassium in various combinations. Analytical results are given to show the influence of the various treatments on the contents of dry matter, nitrogen, phosphorus and potassium of roots and tops of the clover at various stages of its development.

**The Effect of Applications of Sodium Chlorate and Ammonium Thiocyanate on Subsequent Sowings of Wheat.** *Bissey and Butler. Jour. Amer. Soc. Agron.*, 1934, 26, 10, p. 838.—Results are given for different series of pot experiments and it is shown that the application of even moderate amounts of sodium chlorate renders the soil more or less sterile for a considerable length of time. With ammonium thiocyanate the period of sterility is short.

**The Influence of Manganese on Different Potato Soil Types.** *B. E. Brown, G. V. C. Houghland, Ora Smith and R. L. Carolus. American Potato Journal, Vol. X, No.* 4.—Magnesium is essential to the development of the normal green colour of plants and when lacking, plants become more or less chlorotic. It is considered to be important in the assimilation of phosphates and in the formation of chlorophyll. In the highly important potato-producing centres of U.S.A., from Maine to Virginia, a certain uniformity of physiological effects was noted. In all sections a chlorosis of potato foliage, chiefly the lower leaves, was observed. In many of the potato fields under observation excessive soil acidity prevailed wherever the trouble was found occurring.

In almost all the cases examined the affected plants were found to be growing on very acid soil, pH 4·2 to 5, which was probably too acid for normal potato development. Coupled with this was the use of fertiliser containing a high proportion of ammoniacal nitrogen which tended to increase the acidity prevailing near the growing plants. As there were no recognisable pathological symptoms it was believed that the chief trouble was improper nutrition of the plants due to some deficiency of an essential element, but analysis of the fertiliser showed that no toxic material was present and that it was normal so far as plant food was concerned. On a sandy loam having a pH 4·2 the effect of adding magnesium sulphate to the fertiliser proved highly beneficial. A chemical analysis was made of potato foliage samples collected on farms where the chlorotic appearance was very marked and from other fields on the same farm where there was no trouble apparent. The data showed clearly that the intake of magnesium was considerably less where the chlorosis prevailed. It is concluded that when the magnesium content of potato plants drops below 0·15 per cent trouble may be expected.

## DAIRYING

**Individuality of the Mammary Glands of the Udder of the Dairy Cow.** *C. W. Turner*, 1934. *Univ. Missouri Res. Bull* 211.—Dr Turner designed a milking machine capable of delivering into separate containers the milk secreted by each of the four quarters of the cow's udder. He found that the two front quarters each produced slightly more than 20 per cent of the total milk yield. The two rear quarters each produced slightly less than 30 per cent. The milk production from the right and left halves was practically uniform. It can thus be reckoned that 40 per cent of the yield of milk of a cow comes from her two fore quarters, while 60 per cent comes from her two hind quarters.

Studying the lactation curves of a group of Holstein and Jersey cows, it was found that the general trend in the rate of milk secretion by quarters was quite uniform throughout the entire lactation period. Considering the average of each breed separately, no tendency was observed for either the front or rear quarters to secrete milk richer in fat than the other, even though there was considerable difference in the average yield of milk.

**Nutritional Aspects of Milk Pasteurisation.** *E. V. M'Callum* (1933), *Am. Jour. Pub. Health*, *24*, 956.—The author indicates the changes in milk caused by pasteurisation and weighs their significance. He states that there is no convincing evidence that raw milk, even if it were safe, is superior to pasteurised milk for infant feeding. An immense amount of clinical evidence, gathered from many countries, shows that pasteurised milk has fulfilled the needs for feeding infants and children for many years, with no evidence of damage, provided that the loss of vitamin C is made good. The author reviews the evidence of experiments on the nutritional value of raw-wheat-treated milk, and concludes that the effect of pasteurisation on the food value of milk is too slight to be apparent even in specially designed experiments and is not apparent on children living under ordinary American conditions. He stresses the menace of bovine tuberculosis to the health of children, and claims that universal pasteurisation is desirable if only for the prevention of this disease among children.

**Proteins, Minerals and Vitamins of Evaporated Milk.** *F. E. Rice* (1934), *Am. Jour. Pub. Health*, *24*, 194.—A brief review of the researches on evaporated milk is here presented. Evaporated milk is shown to be a successful food for infants, owing in large measure to the soft, easily digested curd which is formed in the stomach. Calcium phosphorus and nitrogen in evaporated milk are supplied in relatively the same amounts as in other whole milks: vitamins A and D are present in evaporated milk to the same extent as in the original milk though part of vitamin B and most of vitamin C are lost. In the sealed tin, evaporated milk is bacteriologically sterile. Children readily accept and approve of the flavour of evaporated milk, while adults quickly become accustomed to it.

**Fat Rising in Cream.** *H. C. Trelogan and W. H. Combs* (1934), *Jour. Dairy Science*, *17*, 675.—This is a study of fat rising in separator cream of varying fat content (20, 30 and 40 per cent fat). Both raw and pasteurised creams were employed, and the temperature at which they were held varied from 40° F. in some trials and 80° F. in others. The authors conclude that butter fat in cream has a tendency to rise and concentrate in the upper portion; that the fat rising is decreased as the butter fat content of the cream is increased; that low temperatures reduce the amount and rapidity of the fat rising, and that pasteurisation of the cream appears to increase slightly the extent of the fat rising.

## ECONOMICS

**British Sugar Beet: Ten Years' Progress under the Subsidy.** *A. Bridges and R. N. Dixey, University of Oxford. Agricultural Economics Research Institute.* Price 2s. 6d. —This publication presents a comprehensive review of the recent development of sugar-beet growing in Great Britain under the stimulus of Government subsidy, and the subject is treated with scientific thoroughness and impartiality.

Between the years 1924 and 1933 the area under this crop increased from 22,000 to 364,000 acres. Expansion appears to have been fairly uniform throughout the various sections of the country, but in England and Wales, 60 per cent of the total acreage is found in the eastern counties. The competition of beet has affected, mainly, grain crops and crops grown for live-stock fodder, including grass. This has not, however, reduced live-stock production in sugar-beet areas. The effect on employment of labour has apparently been rather to check a decline than to result in any increase. This has occurred as a result of concurrent tendencies to extensification.

A considerable volume of statistical material is provided which throws light upon the nature and trends of production costs. The sample from which the data are drawn covers a wide area, but a tendency to concentration on the better lands would influence interpretation. Total costs per acre, including transport, show an appreciable decline over the period to £17 and £18 in 1931 and 1932. This has been achieved by reductions in all items, including labour, which constitutes the largest element. This tendency has permitted profits to be well maintained in spite of declining prices due to reduction of subsidy and lower sugar prices. The average margin of profit in 1932 was calculated to be 14s. 1d. per ton. This aspect of development is clearly satisfactory, but general commendation is qualified by reference to the low average yield at the start and the absence of any appreciable improvement. It is worth mentioning here that the Report on the Sugar-beet Industry at Home and Abroad brings out the fact that sugar-beet yields in this country are lower than in any other country in the world. It is noted that profits appear to be closely connected with soil character; fen soils, apparently, having a definite advantage.

The progress in production has involved a cost of approximately £40,000,000 over a period which is long enough to permit of adequate adjustments, but the conclusion remains that "it is difficult to see how production of sugar from home-grown beet can be organised in Great Britain as a commercial proposition." While the necessity of producing near factories and in the better areas prevents the crop being an ideal one for a relief policy, its effect on employment may perhaps be considered to justify its maintenance for social reasons. Maintenance involves assistance which should be based on the following principles: (1) a price attractive only to suitable growers; (2) some limit to the quantity on which the subsidy will be paid; (3) the subsidy should be related to the price of sugar and should be reviewed at short intervals.

**The Planning of Britain's Food Imports: A Quantitative Study of the Effects of Recent Legislation.** *K. A. H. Murray and Ruth L. Cohen. University of Oxford, Agricultural Economics Research Institute.* Price 3s. 6d.—In a brief review it is impossible to do justice to the wealth of valuable information contained in this publication, which is interesting not only as a study of import trends but also from the point of view of statistical methodology.

As stated, "the purpose of this study is to measure the changes which have occurred in the volume of food imports in recent years." To make this possible some method of combining bushels of onions and great hundreds of eggs is necessary. The authors have performed an invaluable service in constructing index numbers which enable them to show that compared with 1928 the volume of total food imports in 1931 was 17 per cent greater but only 7 per cent greater in 1933. In addition, index numbers relating to meat, dairy products, wheat and flour, eggs, vegetables and fruits, and 28 others relating to specific commodities have been constructed, which indicate the quantitative changes in imports of each. Both in the analysis of total imports and imports of commodities a distinction is made between supplies from Empire and foreign sources, separate series of indexes being presented for each.

These series of index numbers provide the bases for concise statements of trends, and throw valuable light on the effect of recent measures involving the control of imports. The following are some of the important conclusions arrived at: (1) The peak of food imports was reached in October 1931; (2) since then there has been a steady decline, although the index for 1933 was still above the 1927-29 level; (3) this decline was entirely due to a reduction of foreign supplies; the Empire index increased from 117 to 141, expansion from these sources being most pronounced in wheat and flour and dairy products; (4) dairy products was the only group to show a continued increase between 1931 and 1933; (5) "in so far as the aim of the Government's policy has been to cut down imports and to give the Empire an expanding share of the imports into the United Kingdom, it has been successful." . . . "The proportion of the total food imports coming from Empire as opposed to foreign countries increased from 38 per cent in 1927-29 and in 1931 to 50 per cent in 1933; (6) the importance of the demand factor is evident from the data. A drastic falling-off in demand is evident, and "if demand conditions remain as at present it will be impossible to raise prices to, say, their 1927-29 level merely by a reduction of supplies to the volume prevailing in those years."

**An Economic Survey of the Poultry Industry.** *C. V. Dawe and J. D. Nutt. Bulletin No. 12, Dept. of Agric. and Hortic., University of Bristol.*—Although the main object of this Report is to study the position of the poultry industry in the Bristol Province, a preliminary study of the conditions affecting poultry-keeping in Great Britain as a whole is made, in order that the industry within the Province may be considered in its true position as part of a nation-wide enterprise.

After dealing with home production, imports, exports, and prices, in the course of which a direct relationship between quantities and prices is established, the poultry industry in the Bristol Province is considered in some detail, on the basis of 24 complete financial records. While the total number of completed records is small, their study does at least give some picture of conditions within the industry.

The production of eggs for the commercial market is the principal objective in most cases, and while there is a wide variation in the size of enterprise dealt with, two main groups are suggested, one in which the size of flock varies from 200 to 400 laying birds, and another from 700 to 900.

Total costs are divided into two portions: (1) primary costs, including such items as foods, purchases of eggs and stock, depreciation of plant and stock and other incidentals;

(2) the remuneration of the factors of production, *i.e.*, land, labour, capital, and the necessary reward of the poultry-keeper. The difference between the total receipts and the total primary costs gives the net output from which the remuneration of each of the factors of production, as paid or estimated, is successively deducted.

Two of the 24 farms under review showed no margin between primary costs and receipts available for distribution amongst the various factors. The same 22 farms which have a positive net output show a margin of receipts after the share due to the first factor of production, rent, has been deducted, but when the costs of hired labour are also deducted the number of farms still showing a surplus available for further distribution is reduced to 19. Of these 19 farms the incomes from 12 only were sufficiently high to provide in addition the payments due in respect of the farmer's own and other unpaid labour and leave a further surplus, but of these 12 only one failed to provide a minimum of 5 per cent on the capital invested and some reward for the entrepreneur.

Considering the 24 farms as one unit, the net output was sufficient to meet all the claims except capital, but since one factor has been insufficiently remunerated, there is nothing available for the reward of the entrepreneur.

**An Economic Survey of Agriculture in the Eastern Counties of England.** *University of Cambridge, Department of Agriculture. Farm Economics Branch. Report No.* 22. Price 2s. 6d.—This publication forms one of a series of studies, commenced in 1931, of the economic position of producers in the Eastern Counties of England. In each of the years the number of farms included in the study has exceeded one thousand.

A detailed statistical analysis of financial and economic data is presented, out of which arises the conclusion that, largely as a result of adaptations in farm organisation, and in spite of declining prices, returns to the farmers in this area, even including wheat deficiency payments, showed an improvement over the preceding two years. In comparison with 1932 gross incomes were 12 per cent higher in 1933, owing to increases in both live-stock and crop receipts ; while the increase in gross charges was only 5 per cent.

Two other chapters present interesting case studies of profitable and unprofitable farm organisations. These are included " primarily to illustrate certain general tendencies which appear to underlie financial success or failure at the present time."

A concluding chapter of miscellanea deals, among other things, with the relation between size of farms and crop yields per acre. An interesting method of analysis is developed and the conclusions reached that " there is a tendency for the yield of cereals and roots to be slightly higher (about 4 per cent) on the large farms than on the small farms, but that with hay the yields per acre on the small farms are considerably greater (about 12 per cent) than on the large farms."

## ANIMAL BREEDING

### *Cattle*

**A Highly Inbred Herd of Pedigree Shorthorn Cattle.** *J. L. Lush.* 1934. *Jour. Hered.*, 25, 208-216.—The champion county group of Shorthorns at the Club Show at the Iowa State Fair in 1931 came from the herd of Mr Neal of Mt. Vernon, Iowa, and were remarkable for their likeness to each other. Only seven steers from this herd have been shown, but everybody has been struck by their uniformity. Prizes have been won at leading Shows, including the International at Chicago. To demonstrate their uniformity, the seven that won at the Des Moines Show did, at a previous Show, take the first seven places in a class of twenty-eight. The remarkable uniformity of this herd was brought to the notice of Professor Lush of Iowa, who discovered that since 1912 only one beast has been added to the herd.

In 1912 Mr Neal bought a Shorthorn bull-calf called " Sultan's Banner." In 1915 another bull was purchased. However, the calves of " Sultan's Banner " were infinitely superior to any other, and it was decided to use a son of this bull, " Banner View," and to discard the bull bought in 1915, only three of whose daughters were retained in the herd. The breeding history, therefore, is that of a herd practically entirely closed to outside blood since 1912.

Naturally there has been a very high degree of inbreeding employed in the maintenance of the herd. The relationship of the present herd to the present bull in use—" Banner "—is distinctly higher than if he averaged being a sire or full-brother to all of them. This bull has now been used so extensively that all the herd is closely related to him, and the next bulls to be used must be his sons. Hence, in the next generation, the amount of inbreeding will increase even more than it is just now. The bull seems to be a good individual himself, and his progeny have proved that he has an unusually desirable hereditary constitution.

The owner has expressed the interesting point of view that he hesitates to look up the pedigrees of most of his animals lest, on the one hand, he become frightened by the amount of inbreeding that might be there or, on the other hand, that he might become so intrigued by some rule or system which he thought he saw that he would begin to follow this system and mate his animals by pedigree rather then by individuality. This statement is the key to one of the reasons for the success of this instance of inbreeding.

In the first place the foundation bull and some of the cows were definitely above the average. In the second place, there has been rigorous selection on economic grounds, regardless of fancy points. The breeding policy was not deliberately planned but developed incidentally in an effort to conserve the good qualities of an outstanding sire. This is a practical demonstration that a moderate sized herd may follow a policy of intense inbreeding and maintain a good herd, and even improve upon it, with the result that the whole herd is nearly as like to each other as ordinary full-sisters.

**Disease-resistant Cattle.** *J. L. Stewart.* 1934. *Report on the Department of Animal Health for the Gold Coast Colony.*—The question of the resistance of cattle to specific diseases is one concerning which there has been more speculation than actual fact. Some years ago it was suggested that a certain type of small West African humpless cattle were naturally resistant to sleeping sickness (trypanosomiasis). In his report, Mr Stewart shows that one particular strain, the Fouta (Malinke) is resistant generally. Cattle of this breed have been brought from French Guinea and are certainly highly resistant to the Gold Coast trypanosomes. Their progeny also appear to have a higher resistance than the ordinary local cattle. Nor was this resistance found to be associated with susceptibility to rinderpest as was at one time thought to be the case.

Further, a West African Shorthorn bull, which had never been exposed to the tsetse-fly, was consigned to a place perpetually infested with fly and where a large proportion of the cattle showed trypanosomes in the blood. For over a year it has been found healthy and no trypanosomes have been found in repeated blood slides.

The writer believes that more attention should be paid to the indigenous humpless breeds of Africa. Owing to the predominance of Zebu cattle, the West African Shorthorn has not received its due share of notice, and there is a popular assumption that its numbers are small in the aggregate. The writer points out that this is not the case and that cattle of the West African Shorthorn type are to be found in French West Africa as well as throughout North Africa, and North-East Africa, as far south as Eritrea. It is obviously the product of natural selection to a high degree.

### *Pigs*

**Riggs in Pigs.** *H. C. M'Phee and S. S. Buckley.* 1934. *Jour. Hered., 25,* 295-303.—Cryptorchidism is the condition which results from the failure of one or both testicles to descend into the scrotum of a male animal; when both testicles fail to descend the animal is called a bilateral cryptorchid and when only one testicle is retained in the abdominal cavity the animal is said to be a unilateral cryptorchid or to exhibit the monorchid condition. Cryptorchidism occurs in all farm animals, but appears to be most common among horses and swine. It is regarded as a most undesirable character since there is a widespread belief that cryptorchids are sterile.

The material for this study consisted of an inbred strain of Chester White pigs which was being developed by continuous brother x sister matings, coupled with selection, in order to establish a herd in which would be combined in the homozygous state as many desirable characteristics as possible. Hence the data collected on the inheritance of cryptorchidism occurred only incidentally. The foundation stock for this inbred strain comprised four litter mates, three sows and one boar (one of the sows produced only one litter of which none of the piglings were used subsequently) in the ancestry, of which there was no record of the occurrence of cryptorchidism. Five generations of brother x sister matings were considered and the incidence of cryptorchidism carefully analysed.

The authors review the facts published in the literature and point out that, while several writers have concluded that the condition is inherited, very little scientific evidence has been advanced in support of this conclusion and exact details of the mode of inheritance have not been determined. Unfortunately, however, their own results, while indicating that the defect is definitely inherited, do not advance to any great extent our knowledge of the type of inheritance involved since the data are not sufficiently complete to form a basis for more than speculation with regard to certain points.

To sum up, the authors assume that cryptorchidism in pigs is a sex-limited recessive character, capable of explanation in the majority of cases on a single factor basis; they suggest that some cases may occur which are not hereditary. They further assume that the unilateral and bilateral types are controlled by the same genetic constitution. They emphasise that the only way in which the condition can be eliminated is by discarding all sows and boars known to have produced cryptorchid offspring, and point out that even with such rigid elimination the defect may appear from time to time, owing to the difficulty of detecting heterozygous animals by breeding tests.

On occasion it is possible that a bilateral cryptorchid boar may be temporarily fertile at a certain period of the year, but, generally speaking, these are infertile animals. The unilateral type of cryptorchid is usually reasonably fertile, but since this paper shows that the two types are obviously associated, then there is a clear danger in breeding from boars which have only one descended testicle. The writers strongly urge that cryptorchids should never be used as sires.

This is an important paper since it traces quite clearly the inheritance of this defect in one of the larger farm animals. That the condition is hereditary in horses, there can be no dispute, but the method of inheritance in the equine race has not been so clearly demonstrated. From this paper, one can adduce that on the whole it is not sound practice to breed from riggs.

### *Poultry*

**Relation of Time of Laying to Hatchability.** *E. M. Funk. Poultry Sci.*, 1934, *13*, 184-187. (*Univ., Missouri, Columbia.*)—Eggs laid in the afternoon had a higher hatchability than those laid before 9 a.m., which is in direct opposition to Hutt's result. The difference in hatchability of morning and afternoon eggs was greater during a cold spell and all night-lights decreased the difference. Warming the eggs for 6 hours immediately after laying, however, showed no effect.

## ANIMAL NUTRITION

**Skimmed Milk and Whey as Feedstuffs.** *H. Bünger. Mitteil. f. Landwirtsch.*, 1934, *49*, 514-515. (*Exp. Stat. for Dairying, Kiel.*)—The importance of milk residues, skimmed milk, butter milk and whey, for farm animals is discussed with reference to the rearing and fattening of calves and pigs, and their use demonstrated as a source of protein for poultry, especially for chicks and laying hens. Whey should be used especially for fattening pigs and for beef cattle.

**Feeding of Fodder Sugar and (Dried Beet) Slices to Horses.** *F. Honcamp, A. Bömer, P. Rintelen and K. Hötzel. Ztschr. Ver. deut. Zucker-Indust.*, 1934, *84*, 112-163.—Comparative 3-month trials with stallions and working geldings and mares showed no disadvantage in any respect from the partial or complete replacement of the normal full ration of oats by rations, equivalent in starch value and protein, consisting of fodder sugar (raw sugar denatured with beet powder, polarisation value 83 per cent) or dried beet slices (50-66 per cent of sugar) with soya bean meal or other nitrogenous adjuncts. No aversion was shown to the sugar rations, which amounted to 2-2·5 kg. of fodder sugar or 2·5-4 kg. of dried beet slices per head per day.

**Ensiled Pulp, Fresh and Ensiled Leaves and Tops of Beetroots as a Feed for Milk Cows.** *J. C. De Ruyter De Wildt. Landbouwk. Tijdschr.*, 1934, *46*, 97. (*Agric. Exp. Stat., Hoorn, Netherlands.*)—Literature is quoted to show that ensiled pulp and, to a less degree, fresh leaves and tops of sugar beets have an unfavourable influence on the odour and flavour of milk. This effect was not seen when ensiled leaves and upper parts were fed.

**Charcoal, an Important Supplement in the Ration of Sows.** *W. Lentz. Ztschr. f. Schweinezucht*, 1934, *27*, 476-477. (*Berlin.*)—Owing to its great absorptive capacity for gases and acids, charcoal may prove a valuable addition to pig rations especially where large quantities of fresh or ensiled plant feeds form the bulk of the ration. In a test at Halle, pigs receiving charcoal in addition to a ration of soya beans and cereals, plus potatoes, sugar beet leaf silage, dried sugar beet and green lucerne showed an extra 15-20 g. live weight increase per day over pigs receiving the same foods without charcoal.

**Use of Rice Cake and Rice Gluten Meal in Pig Fattening.** *Göhner. Ztschr. f. Schweinezucht*, 1934, *41*, 23-25. (*Hohehorst, St Magnus, Bremen.*)—Rice cake and rice gluten feed are obtained as by-products in the manufacture of rice starch. Both were found to be suitable for pig feeding. Rice cake must always be fresh or it is not readily eaten and should be fed in small quantities to young pigs and gradually increased with age. Rice gluten feed is a better food for pigs than rice cake and may form 10 per cent of a ration for pigs of 25-50 kg. and 20 per cent for pigs above 50 kg.

**Ground Oats as a Substitute for Wheat Bran and Wheat Middlings in Rations for Chicks.** *R. E. Roberts and C. W. Carrick. Poultry Sci.*, 1934, *13*, 135-140. (*Agric. Exp. Stat. Purdue Univ., Lafayette, Indiana.*)—No appreciable difference was found in rate of growth, mortality or food consumed per unit of gain, where 30 per cent of ground oats was substituted for 15 per cent each of wheat bran and wheat middlings. The result appeared to be unaffected whether the ration contained combinations of meat meal or meat and bone meal with dried milk.

**Skimmed Milk in the Rations of Laying Hens.** *H. Lang. Arch. f. Geflügelkunde*, 1934, *8*, 65-73. (*Animal Breeding Inst., Univ. Giessen.*)—Sour skimmed milk in amounts of 250-300 g. per head per day is an adequate substitute for other animal and protein feeds and is just as cheap. Hens given sour skimmed milk showed a higher egg yield, greater egg weight, delayed moulting, greater body weight and better health than controls. Further, the eggs from these hens gave higher percentage fertility and hatchability and larger numbers of chicks were reared.

# STATISTICS

## PRICES OF AGRICULTURAL PRODUCE, FEEDING STUFFS, AND FERTILISERS IN SEPTEMBER, OCTOBER, AND NOVEMBER, 1934

### Live Stock : Monthly Averages of Prices at certain representative Scottish Markets.

*(Compiled from Returns received from the Department's Market Reporters)*

| Description | September | | | October | | | November | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality |
| FAT STOCK :— | | | | | | | | | |
| *Cattle— | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* |
| Aberdeen-Angus .. .. | 47 10 | 43 4 | 39 11 | 46 8 | 42 3 | 38 10 | 46 4 | 42 3 | 39 0 |
| Cross-bred (Shorthorn) | 43 1 | 39 5 | 30 2 | 42 5 | 38 3 | 27 8 | 42 7 | 38 9 | 29 7 |
| Galloway .. .. | 39 11 | 37 7 | .. | 38 6 | 35 11 | .. | 38 1 | 35 1 | .. |
| Ayrshire .. .. | 38 11 | 35 7 | 32 6 | 35 8 | 32 6 | .. | 39 2 | 33 11 | 31 2 |
| Blue Grey .. .. | 46 4 | 42 11 | 40 2 | 47 9 | 43 8 | 40 0 | 45 1 | 42 11 | 40 0 |
| Highland .. .. | 41 0 | 37 6 | .. | 40 9 | 36 3 | 32 6 | 42 2 | 39 9 | 39 0 |
| | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb<br>*d.* | per lb.<br>*d.* |
| †Veal Calves .. .. | 11¼ | 4 | .. | 11½ | 3¾ | .. | 12 | 3½ | .. |
| †Sheep— | Hoggs under 60 lb. per lb.<br>*d.* | 60 lb. and upw'd. per lb.<br>*d.* | Ewes per lb.<br>*d.* | Hoggs under 60 lb. per lb.<br>*d.* | 60 lb. and upw'd. per lb.<br>*d.* | Ewes per lb.<br>*d.* | Hoggs under 60 lb. per lb.<br>*d.* | 60 lb. and upw'd. per lb.<br>*d.* | Ewes per lb.<br>*d.* |
| Cheviot .. .. | 10¼ | 10 | 6½ | 10 | 9½ | 6 | 10¼ | 9½ | 5¾ |
| Half-bred .. .. | 10¾ | 10¼ | 6¾ | 10 | 9½ | 6 | 10¼ | 9½ | 6 |
| Blackface .. .. | 10½ | 10¼ | 6½ | 10 | 9½ | 6 | 10½ | 9½ | 6 |
| Greyface .. .. | 10¾ | 10¼ | 6¾ | 10¼ | 9½ | 6 | 10¼ | 9½ | 5¾ |
| Down Cross .. .. | 10¾ | 10¼ | 5½ | 9¾ | 9¼ | 5 | 10¼ | 9¼ | 5 |
| †Pigs— | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* |
| Bacon Pigs .. .. | 8 7 | 7 8 | .. | 8 4 | 7 5 | .. | 8 5 | 7 6 | .. |
| Porkers .. .. | 9 5 | 8 6 | .. | 9 3 | 8 5 | .. | 9 3 | 8 3 | .. |

* Live weight. † Estimated dressed carcase weight.

## LIVE STOCK: Monthly Averages of Prices (per head) at certain representative Scottish Markets—(*continued*).

| DESCRIPTION | SEPTEMBER | | | OCTOBER | | | NOVEMBER | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality |
| STORE STOCK:— | | | | | | | | | |
| CATTLE— | | | | | | | | | |
| Aberdeen-Angus: | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. |
| Yearlings .. .. | 15 3 | 11 18 | 11 5 | 14 18 | 11 9 | 8 18 | 13 15 | 10 13 | 7 14 |
| Two-year-olds .. | 18 19 | 15 13 | 12 15 | 17 18 | 14 18 | 10 15 | 17 12 | 14 4 | 10 3 |
| Cross-bred (Shorthorn) | | | | | | | | | |
| Yearlings .. .. | 14 3 | 11 0 | 10 3 | 13 13 | 10 4 | 8 4 | 12 17 | 9 9 | 7 11 |
| Two-year-olds .. | 18 6 | 14 15 | 12 8 | 17 11 | 14 1 | 10 7 | 16 17 | 13 8 | 10 3 |
| Galloway: | | | | | | | | | |
| Yearlings .. .. | 12 5 | 9 10 | .. | 13 1 | 10 10 | .. | 13 6 | 10 10 | .. |
| Two-year-olds .. | 18 0 | 14 10 | .. | 17 8 | 14 4 | .. | .. | 13 8 | .. |
| Ayrshire: | | | | | | | | | |
| Yearlings .. .. | 11 15 | 9 0 | .. | 10 9 | 9 3 | .. | 10 10 | .. | .. |
| Two-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Blue Grey: | | | | | | | | | |
| Yearlings .. .. | 13 8 | .. | .. | 12 0 | .. | .. | 13 8 | .. | .. |
| Two-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Highland: | | | | | | | | | |
| Yearlings .. .. | .. | .. | .. | 8 8 | 6 17 | 5 8 | .. | 6 13 | 5 0 |
| Two-year-olds .. | .. | .. | .. | 11 8 | 9 19 | 8 15 | .. | 9 4 | 7 5 |
| Three-year-olds .. | .. | .. | .. | 14 3 | 12 8 | 11 7 | .. | .. | 11 0 |
| DAIRY COWS— | | | | | | | | | |
| Ayrshire: | | | | | | | | | |
| In milk .. .. | 26 2 | 18 19 | 14 16 | 27 14 | 19 19 | 15 2 | 27 4 | 19 3 | 14 13 |
| Calvers .. .. | 26 7 | 19 8 | 15 7 | 27 2 | 19 18 | 15 13 | 27 2 | 19 18 | 15 2 |
| Shorthorn Cross: | | | | | | | | | |
| In milk .. .. | 26 19 | 19 16 | 19 2 | 27 8 | 20 4 | 19 5 | 27 19 | 20 5 | 19 0 |
| Calvers .. .. | 25 17 | 18 13 | 17 5 | 26 3 | 18 15 | 16 10 | 26 8 | 18 9 | 15 16 |
| SHEEP— | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| Cheviot Hoggs .. | .. | .. | .. | .. | 28 6 | .. | .. | .. | .. |
| Half-bred Hoggs .. | .. | .. | .. | 44 0 | 30 0 | .. | 33 2 | .. | .. |
| Blackface Hoggs .. | 21 0 | 12 0 | .. | 25 10 | 18 2 | .. | 21 6 | 14 6 | .. |
| Greyface Hoggs .. | 35 0 | 24 0 | .. | 35 4 | 25 10 | .. | 36 3 | 27 6 | .. |
| Down Cross Hoggs | 34 0 | 28 0 | .. | 30 4 | 24 8 | .. | 37 8 | 31 4 | .. |
| PIGS— | | | | | | | | | |
| (6 to 10 weeks old) | 31 4 | 20 6 | .. | 29 1 | 18 9 | .. | 29 10 | 18 5 | .. |

## DEAD MEAT : Monthly Average Prices at Dundee, Edinburgh, and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | QUALITY | SEPTEMBER | | | OCTOBER | | | NOVEMBER | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Dundee | Edinburgh | Glasgow | Dundee | Edinburgh | Glasgow | Dundee | Edinburgh | Glasgow |
| BEEF :— | | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* |
| Home-fed— | | | | | | | | | | |
| Bullock or Heifer .. | 1 | 7¾ | 7⅝ | 8¾ | 7¼ | 6⅞ | 8¼ | 7 | 6½ | 8 |
| | 2 | 7¼ | .. | 7¾ | 6¾ | .. | 7½ | 6⅜ | .. | 7 |
| Bull .. .. .. | 1 | 5¾ | 5⅛ | 6 | 5½ | 5 | 5¾ | 5½ | 4⅞ | 5½ |
| | 2 | 5 | .. | 5¾ | 5 | .. | 5¼ | 5 | .. | 5 |
| Cow .. .. .. | 1 | 4⅞ | 4⅞ | 5¼ | 4⅝ | 4¾ | 5 | 4½ | 4¾ | 4¾ |
| | 2 | 4½ | .. | 4½ | 4⅛ | .. | 4⅛ | 4 | .. | 3⅝ |
| Irish— | | | | | | | | | | |
| Bullock or Heifer .. | 1 | .. | .. | 7½ | .. | .. | 7¼ | .. | .. | 7 |
| | 2 | .. | .. | 7 | .. | .. | 6½ | .. | .. | 6 |
| Argentine Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | 4½ | 4¼ | .. | 4⅜ | 4¼ | .. | 4½ | 4½ | .. |
| | 2 | .. | 3½ | .. | .. | 3½ | .. | .. | 3½ | .. |
| Fore ,, .. | 1 | 3½ | 3¼ | .. | 3½ | 3¼ | .. | 3½ | 3¼ | .. |
| | 2 | .. | 2⅝ | .. | .. | 2⅝ | .. | .. | 2⅝ | .. |
| Argentine Chilled— | | | | | | | | | | |
| Hind Quarters .. | 1 | 6¾ | 7 | 6⅜ | 6½ | 6⅜ | 6 | 5⅞ | 5⅝ | 5¾ |
| | 2 | .. | 6 | 5¾ | .. | 5¾ | 5½ | .. | 5 | 5⅛ |
| Fore ,, .. | 1 | 4⅛ | 4⅛ | 3⅝ | 4 | 4⅛ | 3¾ | 4 | 4 | 3¾ |
| | 2 | 4 | 3½ | .. | .. | 3⅜ | .. | .. | 3½ | 3½ |
| Brazilian Chilled— | | | | | | | | | | |
| Hind Quarters .. | 1 | .. | .. | 4⅝ | .. | .. | 4¾ | .. | .. | .. |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Australian Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | .. | .. | 3⅜ | .. | .. | 3½ | .. | .. | 3½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Crops .. .. | 1 | .. | .. | 2¾ | .. | .. | 3 | .. | .. | 3 |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| New Zealand Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | .. | .. | 3½ | .. | .. | 3¾ | .. | .. | 3¾ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Fore ,, .. | 1 | .. | .. | 2½ | .. | .. | 2¾ | .. | .. | 2¾ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| MUTTON :— | | | | | | | | | | |
| Hoggs, Blackface .. | under 60 lb. | 11 | 9⅝ | 10¾ | 10⅞ | 9¼ | 9¾ | 10⅛ | 8⅝ | 9⅜ |
| | 60 lb. & over | 10 | .. | 10⅜ | 10 | .. | 9⅜ | 9⅜ | .. | 9 |
| ,, Cross .. | under 60 lb. | 11 | 9⅝ | 10¾ | 10⅞ | 9¼ | 9¾ | 10⅛ | 8⅝ | 9⅜ |
| | 60 lb. & over | 10 | .. | 10⅜ | 10 | .. | 9⅜ | 9⅜ | .. | 9 |
| Ewes, Cheviot .. | 1 | .. | 6 | 6¼ | .. | 5¾ | 5⅞ | .. | 5½ | 5⅝ |
| | 2 | .. | .. | 5¾ | .. | .. | 5½ | .. | .. | 5¼ |
| ,, Blackface .. | 1 | 7½ | 6 | 6¼ | 6⅞ | 5¾ | 5⅞ | 6¼ | 5½ | 5⅝ |
| | 2 | 6½ | .. | 5¾ | 6 | .. | 5½ | 5½ | .. | 5¼ |
| ,, Cross .. .. | 1 | 6 | 6 | 6¼ | 5⅜ | 5¾ | 5⅞ | 5 | 5½ | 5⅝ |
| | 2 | 5 | .. | 5¾ | 4⅝ | .. | 5½ | 4⅛ | .. | 5¼ |
| Argentine Frozen .. | 1 | .. | .. | 3½ | .. | .. | 3½ | .. | .. | 3½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Australian ,, .. | 1 | .. | 5 | 3¾ | .. | 5⅛ | 3¾ | .. | 5⅜ | 3¾ |
| | 2 | .. | 4 | .. | .. | 3⅞ | .. | .. | 3½ | .. |
| New Zealand ,, .. | 1 | .. | .. | 4⅝ | .. | .. | 5 | .. | .. | 5 |
| | 2 | .. | .. | 3⅝ | .. | .. | 3¾ | .. | .. | 3¾ |
| LAMB :— | | | | | | | | | | |
| Home-fed .. .. | 1 | 11½ | .. | 10¾ | 11 | .. | 10 | .. | .. | 9½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| New Zealand Frozen | 1 | .. | 7½ | 7¼ | .. | 7¼ | 7½ | .. | 7⅛ | 7 |
| | 2 | .. | 6½ | .. | .. | 6⅛ | .. | .. | 6⅛ | .. |
| Australian ,, .. | 1 | .. | .. | 6⅜ | .. | .. | 6½ | .. | .. | 6½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Argentine ,, .. | 1 | .. | .. | 6⅜ | .. | .. | 6½ | .. | .. | 6½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| PORK :— | | *per cwt*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt*<br>*s. d.* | *per cwt*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt*<br>*s. d.* |
| Home-fed .. .. | 1 | 74 8 | 76 3 | 84 0 | 78 5 | 73 3 | 82 7 | 79 4 | 78 9 | 77 0 |
| | 2 | 46 8 | .. | 72 4 | 48 6 | .. | 71 10 | 46 8 | .. | 70 0 |
| Imported .. .. | 1 | .. | .. | 60 8 | .. | .. | 65 4 | .. | .. | 65 4 |

## EGGS: Monthly Average Wholesale Prices at Aberdeen, Kilmarnock, Lanarkshire, and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | WEIGHT PER 120 | QUALITY | SEPT. | OCT. | NOV. |
|---|---|---|---|---|---|
| | lb. | | s. d. | s. d. | s. d. |
| **ABERDEEN—** | | | | | |
| Country .. .. per doz. | .. | 1 | 1 2½ | 1 4¾ | 1 11 |
| | .. | 2 | 1 1½ | .. | .. |
| Duck .. .. ,, | .. | 1 | .. | 1 5 | .. |
| **KILMARNOCK—** | | | | | |
| Country (ungraded) per doz. | .. | 1 | 1 5 | 1 10 | 2 2 |
| **LANARKSHIRE—** | | | | | |
| Country "Standard" per doz. | .. | .. | 1 10 | 2 0 | 2 5½ |
| **GLASGOW—** | | | | | |
| National Mark— | | | | | |
| "Special" .. per doz. | .. | .. | 1 5 | 1 11½ | 2 4½ |
| "Standard" .. ,, | .. | .. | 1 4 | 1 10 | 2 3 |
| "Medium" .. ,, | .. | .. | 1 2½ | 1 5¼ | 1 10¼ |
| "Special" .. per 120 | .. | .. | 14 2 | 19 6 | 23 8 |
| "Standard" .. ,, | .. | .. | 13 1 | 18 2 | 22 6 |
| "Medium" .. ,, | .. | .. | 11 11 | 14 2 | 18 6 |
| Northern Ireland ,, | 17 | .. | 14 2 | 18 11 | 22 0 |
| ,, ,, | 15½ | .. | 13 0 | 17 8 | 21 0 |
| ,, ,, | 14 | .. | 11 10 | 15 4 | 18 3 |
| ,, (Duck) ,, | .. | 1 | 11 5 | 12 4 | 14 10 |
| Irish Free State .. ,, | 16 | .. | 12 5 | 14 11 | 19 2 |
| ,, ,, .. ,, | 15 | .. | 12 0 | 14 2 | 18 5 |
| ,, .. ,, | 14 | .. | 10 8 | 12 8 | 15 2 |
| ,, (Cold Stored) "Extra" ,, | .. | .. | 10 2 | 10 4 | .. |
| ,, "Selected" ,, | .. | .. | 9 8 | 10 2 | .. |
| ,, (Duck) ,, | .. | 1 | 10 11 | 11 4 | 14 4 |
| Australian .. ,, | 16 | .. | .. | 13 0 | 13 4 |
| ,, .. ,, | 15 | .. | .. | 12 5 | 12 8 |
| Canadian (ungraded) | .. | .. | .. | 11 1 | 11 4 |
| Danish .. .. ,, | 18 | .. | .. | .. | 20 3 |
| ,, .. .. ,, | 17 | .. | .. | 13 8 | 19 6 |
| ,, .. .. ,, | 15½ | .. | 11 10 | 14 0 | 18 1 |
| ,, .. .. ,, | 14 | .. | 11 1 | .. | .. |
| ,, (Cold Stored) ,, | 15½ | .. | .. | 10 3 | 10 11 |
| ,, ,, (ungraded) ,, | .. | .. | .. | .. | 10 9 |
| Finnish .. .. ,, | 15½ | .. | 10 4 | 10 3 | .. |
| Swedish .. .. ,, | 18 | .. | .. | 13 11 | .. |
| ,, .. .. ,, | 15½ | .. | 10 8 | 12 7 | .. |
| ,, .. .. ,, | 14 | .. | 9 9 | 10 6 | .. |
| Polish (ungraded) ,, | .. | 1 | 7 3 | 7 3 | 7 11 |
| ,, ( ,, ) ,, | .. | 2 | 7 0 | .. | 7 6 |

## PROVISIONS: Monthly Average Wholesale Prices (per cwt.) at Glasgow.

| DESCRIPTION | QUALITY | SEPT. | OCT. | NOV. |
|---|---|---|---|---|
| | | s. d. | s. d. | s. d. |
| **BUTTER—** | | | | |
| Irish Creamery .. .. .. | 1 | 78 6 | 74 5 | 83 0 |
| ,, (unsalted) .. .. | 1 | 81 6 | 77 5 | 86 0 |
| Australian .. .. .. | 1 | 78 3 | 72 5 | 80 3 |
| Danish .. .. .. | 1 | 111 0 | 115 5 | 126 6 |
| ,, (unsalted) .. .. | 1 | 114 0 | 118 5 | 129 6 |
| New Zealand .. .. .. | 1 | 81 6 | 74 5 | 81 3 |
| | 2 | 77 8 | 70 4 | 79 0 |
| ,, (unsalted) .. .. | 1 | 83 6 | 77 5 | 84 3 |
| Swedish .. .. .. | 1 | 83 0 | 92 5 | 110 6 |
| Latvian .. .. .. | 1 | 71 9 | 78 0 | 92 0 |
| Finnish .. .. .. | 1 | 94 0 | 94 0 | .. |
| **CHEESE—** | | | | |
| Cheddar .. .. .. .. | 1 | 64 6 | 70 0 | 75 0 |
| | 2 | 52 0 | 52 0 | 59 0 |
| Cheddar Loaf .. .. | 1 | 76 0 | 76 0 | 76 0 |
| | 2 | 72 0 | 72 0 | 72 0 |
| Dunlop .. .. .. | 1 | 60 0 | 60 0 | 60 0 |
| | 2 | 54 0 | 54 0 | 48 0 |
| Canadian .. .. .. | 1 | 60 0 | 60 0 | 61 6 |
| | 2 | .. | 57 6 | 58 0 |
| New Zealand (Coloured) .. | 1 | 50 0 | 54 5 | 58 6 |
| ,, (White) .. .. | 1 | 54 0 | 57 5 | 59 9 |
| **HAMS—** | | | | |
| Irish (Smoked) .. .. .. | 1 | 157 0 | 140 0 | 132 0 |
| | 2 | 136 3 | 118 0 | 110 0 |
| American (Long Cut, Green) .. | 1 | 100 0 | 100 0 | .. |
| ,, (Short Cut, ,, ) .. | 1 | 96 6 | 93 10 | 88 0 |
| Canadian (Long Cut, ,, ) .. | 1 | 100 0 | 100 0 | 94 0 |
| **BACON—** | | | | |
| Ayrshire (Rolled) .. .. | 1 | 134 0 | 123 1 | 116 8 |
| English Wiltshire (Green) .. | 1 | 110 0 | 99 2 | 100 0 |
| ,, (Dried or Smoked) .. | 1 | 116 0 | 103 7 | 104 0 |
| Irish (Green, Wiltshire Style) .. | 1 | 109 0 | 98 10 | 97 0 |
| ,, (Dried or Smoked) .. | 1 | 117 0 | 103 7 | 101 0 |
| ,, (Long Clear) .. .. | 1 | 119 0 | 108 10 | 108 0 |
| Canadian Sides (Green) .. | 1 | 97 3 | 87 0 | 87 0 |
| Danish Sides .. .. .. | 1 | 107 6 | 98 0 | 98 0 |
| Dutch (Green, Wiltshire Style) | 1 | 100 0 | 91 10 | 93 0 |
| **LARD—** | | | | |
| American .. .. .. | 1 | 46 6 | 47 2 | 48 9 |

## FRUIT AND VEGETABLES: Monthly Average Wholesale Prices at Glasgow.

(*Compiled from Returns received from the Department's Market Reporter*)

| DESCRIPTION | | QUALITY | SEPTEMBER | OCTOBER | NOVEMBER |
|---|---|---|---|---|---|
| FRUIT:— | | | | | |
| Apples— | | | | | |
| | per | | s. d. | s. d. | s. d. |
| Lord Derby .. | .. barrel.* | 1 | 6 0 | 5 8 | 6 0 |
| Bramley Seedling | .. „ * | 1 | 5 0 | 6 0 | .. |
| Other Cooking .. | .. „ * | 1 | 4 3 | 5 4 | 5 0 |
| American .. | .. case.† | 1 | 13 10 | 10 10 | 10 3 |
| „ .. | .. barrel.†† | 1 | 25 1 | 22 11 | 18 9 |
| Pears— | | | | | |
| Californian .. | .. box.‖ | 1 | 13 10 | 14 6 | 15 8 |
| Blackberries .. | .. lb. | 1 | 0 3¼ | 0 3 | .. |
| Damsons .. .. | .. „ | 1 | 0 2½ | 0 2¼ | .. |
| Plums— | | | | | |
| Victoria .. | .. „ | 1 | 0 3¼ | .. | .. |
| VEGETABLES:— | | | | | |
| Beans— | | | | | |
| Dwarf .. .. | .. lb. | 1 | 0 3 | 0 3¼ | 0 4½ |
| Beet .. .. | .. cwt. | 1 | 4 8 | 4 0 | 5 0 |
| Brussels Sprouts .. | .. net.ø | 1 | 4 5 | 3 4 | 3 0 |
| Cabbage— | | | | | |
| Scottish .. .. | .. dozen. | 1 | 1 3 | 1 3 | 1 3 |
| Coleworts .. | .. „ | 1 | 1 0 | 1 0 | 1 0 |
| Red .. .. | .. „ | 1 | 3 0 | 3 3 | 3 0 |
| Savoy .. .. | .. „ | 1 | .. | 2 1 | 1 6 |
| Carrots— | | | | | |
| British .. .. | .. cwt. | 1 | 5 9 | 4 11 | 5 0 |
| Cauliflowers— | | | | | |
| British .. .. | .. dozen. | 1 | 2 9 | 3 1 | 4 2 |
| Celery .. .. | .. bunch. | 1 | 1 6 | 1 7 | 2 2 |
| „ (Washed) .. | .. box.§ | 1 | .. | 3 10 | 3 7 |
| Cucumbers .. | .. dozen. | 1 | 4 8 | 5 4 | 6 0 |
| Greens .. .. | .. bunch. | 1 | .. | 0 6 | 0 5¾ |
| Leeks .. .. | dozen bunches. | 1 | 2 3 | 2 2 | 2 0 |
| Lettuce— | | | | | |
| Cos .. .. | .. dozen. | 1 | 1 2 | 1 0 | 1 0 |
| Cabbage .. | .. „ | 1 | 1 2 | 1 1 | 1 5 |
| Onions— | | | | | |
| *Spring* .. .. | .. bunch. | 1 | 0 4 | 0 6 | 0 6 |
| *Dutch* .. .. | .. bag.** | 1 | 8 2 | 7 8 | 7 6 |
| *Valencia* .. | .. case.†† | 1 | 9 5 | 9 2 | 8 8 |
| Parsley .. .. | .. cwt. | 1 | 8 6 | 8 0 | 8 0 |
| Parsnips .. .. | .. „ | 1 | 12 0 | 9 5 | 8 0 |
| Peas .. .. | .. „ | 1 | 16 0 | 12 0 | .. |
| Radishes .. .. | dozen bunches. | 1 | 1 3 | .. | .. |
| Rhubarb .. .. | .. cwt. | 1 | 4 3 | 4 8 | .. |
| Spinach .. .. | .. stone. | 1 | 3 2 | 3 0 | 3 6 |
| Tomatoes— | | | | | |
| Scottish .. | .. lb. | 1 | 0 4¾ | 0 6¼ | 0 6 |
| Channel Islands | .. „ | 1 | 0 2¾ | 0 3½ | 0 3¼ |
| Turnips .. .. | .. cwt. | 1 | 3 1 | 2 1 | 2 0 |
| Vegetable Marrow | .. dozen. | 1 | 3 5 | 5 1 | 5 6 |

* 56 lb.    † 40 lb. (approx.).    †† 9 stone.    ‖ 46 lb.
ø 20 lb.    § 24 heads.    ** 7½ stone.

## POTATOES : Monthly Average Wholesale Prices (per ton) at Aberdeen, Dundee, Edinburgh, and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| MARKET | Quality | FIRST EARLIES | SECOND EARLIES | LATE VARIETIES | | | |
|---|---|---|---|---|---|---|---|
| | | | | RED SOILS | | OTHER SOILS | |
| | | | | Golden Wonder | Other | Golden Wonder | Other |
| | | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| | | SEPTEMBER | | | | | |
| Aberdeen .. | 1 | 5 5 0 | 4 18 9 | .. | .. | .. | .. |
| Dundee .. | 1 | .. | 4 7 6 | .. | .. | .. | .. |
| Edinburgh .. | 1 | 4 10 0 | 4 6 8 | .. | .. | .. | .. |
| Glasgow .. | 1 | 5 2 6 | 4 11 3 | .. | .. | .. | .. |
| | | OCTOBER | | | | | |
| Aberdeen .. | 1 | .. | 4 5 0 | .. | .. | .. | 4 1 0 |
| Dundee .. | 1 | .. | 3 10 0 | .. | .. | .. | 3 7 0 |
| Edinburgh .. | 1 | .. | 4 0 0 | .. | .. | .. | 4 0 0 |
| Glasgow .. | 1 | .. | 3 10 6 | .. | .. | 5 0 0 | 4 3 0 |
| | | NOVEMBER | | | | | |
| Aberdeen .. | 1 | .. | .. | .. | .. | 4 10 0 | 3 10 8 |
| Dundee .. | 1 | .. | 3 10 0 | .. | .. | 4 10 0 | 3 3 9 |
| Edinburgh .. | 1 | .. | 4 0 0 | .. | .. | .. | 4 0 0 |
| Glasgow .. | 1 | .. | 3 11 3 | .. | .. | 5 5 0 | 3 13 9 |

## ROOTS, HAY, STRAW, AND MOSS LITTER : Monthly Average Prices (per ton) at Aberdeen, Dundee, Edinburgh, and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| MARKET | Quality | ROOTS | | | HAY | | STRAW | | | MOSS LITTER |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Carrots | Yellow Turnips | Swedes | Rye Grass and Clover | Timothy | Wheat | Barley | Oat | |
| | | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| | | SEPTEMBER | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 63 9 | .. | .. | .. | 35 0 | .. |
| †Dundee .. | 1 | .. | ø22 6 | ø25 0 | 90 0a<br>76 3b | .. | 47 6 | .. | 50 0a<br>45 0d | 52 6c |
| ‖Edinburgh .. | 1 | .. | .. | .. | 80 0a<br>80 0b | .. | 27 6 | .. | 27 6 | .. |
| aGlasgow .. | 1 | .. | .. | .. | 75 0 | 85 0 | 35 0 | .. | 37 6 | 33 2e |
| | | OCTOBER | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 65 0 | .. | .. | .. | 36 0 | .. |
| †Dundee .. | 1 | .. | ø20 5 | ø23 4 | 90 0a<br>80 0b | 85 0 | 40 6 | .. | 50 0a<br>45 0d | 52 6c |
| ‖Edinburgh .. | 1 | .. | .. | .. | 81 0a<br>80 0b | .. | 27 6 | .. | 27 6 | .. |
| aGlasgow .. | 1 | .. | .. | .. | 75 0 | 85 0 | 35 0 | .. | 38 0 | 33 2e |
| | | NOVEMBER | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 68 4 | .. | .. | .. | 40 0 | .. |
| †Dundee .. | 1 | .. | ø20 0 | ø20 9 | 90 0a<br>81 3b | 85 0 | 43 2 | .. | 51 3a | .. |
| ‖Edinburgh .. | 1 | .. | .. | .. | 86 3a<br>81 3b | .. | 26 11 | .. | 27 6 | .. |
| aGlasgow .. | 1 | .. | .. | .. | 75 0 | 85 0 | 35 0 | .. | 40 0 | 33 2e |

* Ex farm, loose.
† Baled straw, delivered in town.
‖ Bunched or baled straw, delivered.
ø Delivered in town.
a Baled and delivered.
b Delivered, loose.
c Dutch Moss Litter, at Quay.
d Bunched and delivered.
e Home Moss Litter, in 1½-cwt. bales.

## Feeding Stuffs: Monthly Average Prices (per ton) at Glasgow and Leith.

*(Compiled from Returns received from the Department's Market Reporters)*

| Description | September | | October | | November | |
|---|---|---|---|---|---|---|
| | Glasgow | Leith | Glasgow | Leith | Glasgow | Leith |
| Linseed Cake— | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Home .. .. .. | 9 11 3 | 9 7 6 | 9 7 0 | 9 4 0 | 8 16 11 | 8 14 5 |
| Foreign .. .. .. | 8 11 11 | 8 15 0 | 8 10 6 | 8 14 0 | 8 6 3 | 8 6 8 |
| Decort. Cotton Cake .. | 6 15 0 | .. | 6 15 0 | .. | 6 16 3 | .. |
| Undecort. Cotton Cake— | | | | | | |
| Egyptian (Home manufactured) .. .. | 5 13 9 | 5 9 5 | 5 4 0 | 5 1 0 | 5 0 0 | 5 1 3 |
| Palmnut Kernel Cake .. | 7 2 6 | .. | 7 2 6 | .. | 7 10 8 | .. |
| Soya Bean Cake .. .. | 8 0 8 | .. | 8 0 0 | .. | 8 0 0 | .. |
| Coconut Cake .. .. | 6 10 8 | .. | 6 9 6 | .. | 6 8 9 | .. |
| Groundnut Cake, undecort.— | | | | | | |
| (40 % Oil and Album.) .. | .. | 7 2 6 | .. | 6 16 3 | .. | 6 8 4 |
| (50 % „ „ ) .. | 6 15 0 | .. | 6 11 0 | .. | 6 10 0 | .. |
| (54 % „ „ ) .. | 6 15 0 | .. | 6 13 0 | .. | 6 12 6 | .. |
| Maize Germ Cake, Home mfd. | 7 15 8 | .. | 7 14 0 | .. | 7 12 10 | .. |
| „ „ Meal .. .. | 6 11 11 | .. | 6 4 0 | .. | 6 0 0 | .. |
| Rice Meal .. .. .. | 5 16 7 | 5 15 0 | 5 11 6 | 5 7 6 | 5 10 11 | 5 8 9 |
| Bean Meal .. .. .. | 8 19 1 | 9 0 0 | 8 12 0 | 8 12 0 | 8 13 2 | 8 10 0 |
| Barley Meal .. .. .. | 8 13 9 | 8 6 3 | 8 11 3 | 8 10 0 | 8 8 9 | 7 14 5 |
| Fish Meal .. .. .. | 16 6 3 | 15 7 6 | 16 2 0 | 15 15 0 | 15 17 6 | 15 14 5 |
| Maize Meal— | | | | | | |
| Home manufactured .. | 7 2 10 | 6 18 9 | 6 11 3 | 6 12 6 | 6 10 0 | 6 8 9 |
| South African, Yellow .. | 6 12 6 | .. | 6 2 10 | 6 0 0 | 5 16 11 | 5 17 6 |
| „ „ White .. | 6 15 0 | .. | 6 0 8 | .. | 5 18 4 | .. |
| Locust Bean Meal .. .. | 7 17 6 | 7 5 0 | 7 18 0 | 7 5 0 | 8 0 0 | 7 5 0 |
| Maize Gluten Feed (Paisley) | 6 7 6 | .. | 6 7 5 | .. | 6 7 8 | .. |
| Maize— | | | | | | |
| Plate .. .. .. | 6 5 0 | 5 19 5 | 5 14 6 | 5 9 0 | 5 11 7 | 5 7 6 |
| African, Flat .. .. | .. | .. | 6 3 9 | .. | 6 5 0 | .. |
| Oats— | | | | | | |
| Home .. .. .. | 7 7 10 | 7 1 8 | 7 13 3 | 7 3 6 | 8 0 4 | 7 1 3 |
| Barley— | | | | | | |
| Home .. .. .. | .. | .. | .. | 7 10 0 | .. | 7 3 9 |
| Imported .. .. .. | 7 15 0 | 7 8 0 | 7 11 6 | 7 5 0 | 7 6 3 | 6 10 0 |
| Wheat— | | | | | | |
| Home .. .. .. | 6 19 5 | 5 13 9 | 6 15 9 | 5 6 6 | 5 16 11 | 5 7 6 |
| „ (Poultry) .. .. | 6 17 6 | .. | 6 1 6 | .. | 5 15 0 | .. |
| Imported .. .. .. | 7 11 3 | 6 16 8 | .. | 6 2 6 | .. | 5 13 9 |
| Middlings (Fine Thirds or Parings) .. .. .. | 7 12 10 | 7 5 0 | 7 8 9 | 7 5 6 | 7 1 11 | 6 16 11 |
| Sharps (Common Thirds) | 7 6 11 | 6 18 2 | 7 4 9 | 7 0 6 | 6 16 3 | 6 15 0 |
| Bran (Medium) .. .. | 7 5 0 | 7 0 0 | 7 1 9 | 6 19 6 | 6 16 3 | 6 12 6 |
| „ (Broad) .. .. | 7 11 3 | 7 12 6 | 7 8 3 | 7 12 0 | 7 1 7 | 7 1 3 |
| Malt Culms .. .. .. | 5 10 0 | 4 15 0 | 5 10 0 | 4 15 0 | 5 8 9 | 4 15 0 |
| Distillers' Mixed Grains (Dried) | .. | 6 15 0 | .. | 6 15 0 | .. | 5 18 4 |
| Distillers' Malt Grains (Dried) | 6 15 4 | .. | 7 0 0 | .. | 6 18 9 | .. |
| Brewers' Grains (Dried) .. | 6 9 7 | 5 10 0 | 6 9 3 | 5 12 0 | 6 8 5 | 5 14 5 |
| Crushed Linseed .. .. | 17 15 0 | .. | 18 4 0 | .. | 18 7 6 | .. |
| Locust Beans (Kibbled and Stoned) .. .. .. | 6 18 9 | 7 0 0 | 6 18 9 | 7 0 0 | 7 1 7 | 7 0 0 |
| Beans— | | | | | | |
| English .. .. .. | .. | .. | 8 2 6 | .. | .. | .. |
| China .. .. .. | 7 18 9 | 7 12 6 | 7 13 3 | 7 15 10 | 7 16 7 | 7 17 6 |
| Egyptian .. .. .. | 8 3 2 | .. | .. | .. | .. | .. |
| Rangoon (Red) .. .. | .. | 6 13 9 | .. | 6 10 0 | .. | 6 10 0 |
| „ (White) .. .. | 6 18 2 | 6 16 8 | 6 17 6 | 6 15 0 | 7 0 0 | 6 15 0 |
| Pease— | | | | | | |
| Karachi (White) .. .. | 9 0 0 | .. | 8 15 0 | .. | 8 12 6 | .. |
| Feeding Treacle .. .. | 5 5 0 | 5 10 0 | 5 5 0 | 5 10 0 | 5 5 0 | 5 10 0 |
| Sugar-Beet Pulp (English) .. | 6 7 11 | .. | .. | .. | 6 5 0 | 6 0 0 |
| „ „ „ (Irish) .. | 6 6 8 | .. | 6 10 5 | 5 17 6 | 6 6 11 | 5 17 6 |
| Linseed Oil, per gall. .. | 0 4 0 | .. | 0 4 0 | .. | 0 4 0 | .. |

## FERTILISERS: Monthly Average Prices (per ton) at Glasgow and Leith.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | Guaranteed Analysis | SEPTEMBER | | OCTOBER | | NOVEMBER | |
|---|---|---|---|---|---|---|---|
| | | Glasgow | Leith | Glasgow | Leith | Glasgow | Leith |
| | % | £ *s.* *d.* | £ *s.* *d.* | £ *s.* *d.* | £ *s.* *d.* | £ *s.* *d.* | £ *s.* *d.* |
| Nitrate of Soda * | N. 15·5 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 |
| Sulphate of Ammonia (Neutral and Granular) * .. | N. 20·6 | 6 16 0 | 6 16 0 | 6 17 6 | 6 17 6 | 6 19 0 | 6 18 3 |
| Calcium Cyanamide † | N. 20·6 | 6 16 2 | .. | 6 17 6 | 6 17 6 | 6 18 9 | 6 17 6 |
| Nitrochalk * .. | N. 15·5 | 7 5 0 | .. | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 |
| Superphosphate .. | P.A. 13·7 | 2 12 6 | .. | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 |
| „ .. | „ 16·0 | 2 17 6 | .. | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 |
| „ .. | „ 18·3 | 3 2 6 | .. | 3 2 6 | 3 2 6 | 3 2 6 | 3 2 6 |
| Ground Mineral Phosphate ** .. | P.A. 26 | 2 10 10 | .. | .. | .. | .. | .. |
| „ „ „ ** .. | „ 27·5 | 2 12 6 | .. | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 |
| „ „ „ ** .. | „ 34 | 3 10 0 | .. | 3 10 0 | 3 10 0 | 3 10 0 | 3 10 0 |
| Potassic Mineral Phosphate | P.A. 18<br>Pot. 10 | 3 10 0 | .. | 3 10 0 | .. | 3 10 0 | .. |
| „ „ „ | P.A. 18<br>Pot. 9 | .. | .. | .. | 3 5 0 | .. | 3 5 0 |
| „ „ „ | P.A. 20<br>Pot. 7·5 | 3 5 0 | .. | 3 5 0 | .. | 3 5 0 | .. |
| „ „ „ | P.A. 21<br>Pot. 10 | .. | .. | .. | 3 10 0 | .. | 3 10 0 |
| Kainit (in bags) .. | Pot. 14 | 3 0 0 | 2 17 6 | 3 0 0 | 2 17 6 | 3 0 0 | 2 17 6 |
| Potash Salts .. | Pot. 20 | 3 15 0 | 3 10 0 | 3 15 0 | 3 10 0 | 3 15 0 | 3 10 0 |
| „ „ .. | „ 30 | 4 10 0 | 4 5 0 | 4 10 0 | 4 2 6 | 4 10 0 | 4 2 6 |
| Muriate of Potash (on basis of 80 per cent. purity) | Pot. 50 | 6 15 8 | 7 0 0 | 6 17 6 | 6 7 6 | 6 17 6 | 6 7 6 |
| Sulphate of Potash (on basis of 90 per cent. purity) | Pot. 48·6 | 7 16 3 | 7 10 0 | 7 17 6 | 7 7 6 | 7 17 6 | 7 7 6 |
| Steamed Bone Flour | N. 0·8<br>P.A. 28 | 6 0 0 | .. | 6 0 0 | 6 2 6 | 6 0 0 | 6 2 6 |
| Bone Meal (Indian) | N. 4<br>P.A. 20 | 6 15 0 | .. | 6 15 0 | 6 15 0 | 6 15 0 | 6 10 8 |
| Potassic Slag | P.A. 12<br>Pot. 6 | .. | .. | .. | 3 7 6 | .. | 3 7 6 |
| Basic Slag ‡ .. | P.A. 12 | 2 5 0 | .. | 2 5 0 | .. | 2 5 0 | .. |
| „ „ .. | „ 13 | 2 7 0 | .. | 2 7 0 | §1 14 6 | 2 7 0 | §1 14 6 |
| „ „ .. | „ 14 | 2 9 0 | .. | 2 9 0 | §1 16 6 | 2 9 0 | §1 16 6 |
| „ „ .. | „ 15 | .. | .. | .. | §1 18 6 | .. | §1 18 6 |
| „ „ .. | „ 15 | .. | .. | .. | 2 10 0 | .. | 2 10 0 |
| „ „ .. | „ 15·75 | .. | .. | .. | §2 0 0 | .. | §2 0 0 |

Abbreviations:—N.=Nitrogen; P.A.=Phosphoric Acid; Pot.=Potash.

* Carriage paid, in 6-ton lots. † Carriage paid, in 4-ton lots.

** Fine grist, 90 per cent fineness through prescribed sieve.

‡ Basic Slag:—At Glasgow—80 per cent citric soluble and 80 per cent fineness; f.o.r., in 6-ton lots.
At Leith—80 per cent citric soluble.

§ Ex ship f.o.r. Grangemouth.

# ABSTRACT OF AGRICULTURAL RETURNS FOR SCOTLAND, 1934

## Collected 4th June 1934 (and comparison with 1933)

## CROPS

| DISTRIBUTION | 1934 | 1933 | INCREASE | | DECREASE | |
|---|---|---|---|---|---|---|
| | *Acres* | *Acres* | *Acres* | *Per Cent.* | *Acres* | *Per Cent.* |
| TOTAL AREA (excluding WATER) | **19,069,007** | 19,069,007 | .. | .. | .. | .. |
| MOUNTAIN and HEATH LAND used for GRAZING (*b*) | **10,409,549** | 10,440,654 | .. | .. | 31,105 | 0·3 |
| TOTAL ACREAGE under CROPS and GRASS | **4,600,440** | 4,613,708 | .. | .. | 13,268 | 0·3 |
| ARABLE LAND | **2,991,578** | 3,030,080 | .. | .. | 38,502 | 1·3 |
| PERMANENT GRASS (*a*) For Hay | **180,734** | 178,913 | 1,821 | 1·0 | .. | .. |
| PERMANENT GRASS (*a*) Not for Hay | **1,428,128** | 1,404,715 | 23,413 | 1·7 | .. | .. |
| TOTAL | **1,608,862** | 1,583,628 | 25,234 | 1·6 | .. | .. |
| Wheat | **97,627** | 78,386 | 19,241 | 24·5 | .. | .. |
| Barley (including Bere) | **96,250** | 59,808 | 36,442 | 60·9 | .. | .. |
| Oats | **816,495** | 855,857 | .. | .. | 39,362 | 4·6 |
| Mixed Grain | **2,127** | 1,769 | 358 | 20·2 | .. | .. |
| Rye | **2,707** | 2,792 | .. | .. | 85 | 3·0 |
| Beans (to be harvested as Corn) | **2,576** | 3,035 | .. | .. | 459 | 15·1 |
| Peas | **515** | 604 | .. | .. | 89 | 14·7 |
| Potatoes | **139,998** | 152,513 | .. | .. | 12,515 | 8·2 |
| Turnips and Swedes | **353,944** | 351,653 | 2,291 | 0·7 | .. | .. |
| Mangolds | **1,738** | 1,389 | 349 | 25.1 | .. | .. |
| Sugar Beet | **7,536** | 1,706 | 5,830 | 341·7 | .. | .. |
| Cabbage | **5,642** | 4,818 | 824 | 17·1 | .. | .. |
| Rape | **10,074** | 9,034 | 1,040 | 11·5 | .. | .. |
| Vetches or Tares, for Seed | **215** | 175 | 40 | 22.9 | .. | .. |
| Vetches, Tares, Beans, Peas, Mashlum, etc., for Fodder | **8,226** | 8,360 | .. | .. | 134 | 1·6 |
| Carrots | **1,009** | 574 | 435 | 75·8 | .. | .. |
| Onions | **180** | 151 | 29 | 19·2 | .. | .. |
| Flax | **52** | 44 | 8 | 18·2 | .. | .. |
| Small Fruit | **9,563** | 8,582 | 981 | 11·4 | .. | .. |
| RYE-GRASS AND OTHER ROTATION GRASSES AND CLOVER For Hay | **393,780** | 391,497 | 2,283 | 0·6 | .. | .. |
| RYE-GRASS AND OTHER ROTATION GRASSES AND CLOVER Not for Hay | **1,022,948** | 1,086,010 | .. | .. | 63,062 | 5·8 |
| TOTAL | **1,416,728** | 1,477,507 | .. | .. | 60,779 | 4·1 |
| OTHER CROPS | **5,621** | 3,988 | 1,633 | 40·9 | .. | .. |
| BARE FALLOW | **12,755** | 7,335 | 5,420 | 73·9 | .. | .. |
| ORCHARDS (*a*) | **1,128** | 1,013 | 115 | 11·4 | | |

## LIVE STOCK

| | *No.* | *No.* | *No.* | *Per Cent.* | *No.* | *Per Cent.* |
|---|---|---|---|---|---|---|
| Horses used for Agricultural Purposes (including Mares for Breeding) | **112,015** | 113,886 | .. | .. | 1,871 | 1·6 |
| Unbroken Horses (including Stallions) One year and above | **15,011** | 14,403 | 608 | 4·2 | .. | .. |
| Unbroken Horses (including Stallions) Under one year | **5,998** | 5,368 | 630 | 11·7 | .. | .. |
| TOTAL | **133,024** | 133,657 | .. | .. | 633 | 0·5 |
| Other Horses | **15,032** | 15,826 | .. | .. | 794 | 5·0 |
| TOTAL OF HORSES | **148,056** | 149,483 | .. | .. | 1,427 | 1·0 |
| Cows in Milk | **368,902** | 364,554 | 4,348 | 1·2 | .. | .. |
| Cows in Calf, but not in Milk | **55,417** | 53,478 | 1,939 | 3·6 | .. | .. |
| Heifers in Calf | **71,908** | 65,877 | 6,031 | 9·2 | .. | .. |
| Bulls being used for Service | **17,612** | 17,530 | 82 | 0·5 | .. | .. |
| Other Cattle :—Two years and above | **192,306** | 199,172 | .. | .. | 6,866 | 3·4 |
| ,, ,, One year and under two | **324,387** | 318,124 | 6,263 | 2·0 | .. | .. |
| ,, ,, Under one year | **282,664** | 274,902 | 7,762 | 2·8 | .. | .. |
| TOTAL OF CATTLE (*c*) | **1,313,196** | 1,293,637 | 19,559 | 1·5 | .. | .. |
| Ewes kept for Breeding | **3,354,367** | 3,385,719 | .. | .. | 31,352 | 0·9 |
| Rams to be used for Service in 1934 | **96,811** | 95,126 | 1,685 | 1·8 | .. | .. |
| Other Sheep :—One year and above | **924,637** | 939,351 | .. | .. | 14,714 | 1·6 |
| ,, ,, Under one year | **3,279,661** | 3,390,948 | .. | .. | 111,287 | 3·3 |
| TOTAL OF SHEEP (*c*) | **7,655,476** | 7,811,144 | .. | .. | 155,668 | 2·0 |
| Sows kept for Breeding | **28,304** | 21,969 | 6,335 | 28·8 | .. | .. |
| Boars being used for Service | **2,832** | 2,459 | 373 | 15·2 | .. | .. |
| Other Pigs | **175,143** | 142,600 | 32,543 | 22·8 | .. | .. |
| TOTAL OF PIGS | **206,279** | 167,028 | 39,251 | 23·5 | .. | .. |

(*a*) Any Crop or Grass grown in Orchards is also returned under its proper heading.
(*b*) Includes Land in Deer Forests used or capable of being used for grazing.
(*c*) Including cattle and sheep grazed on Deer Forests.

## ACREAGE under WHEAT, BARLEY (including BERE) and OATS in each COUNTY on 4th June 1934, with COMPARISON for 1933.

| COUNTIES | Wheat | | Barley (including Bere) | | Oats | |
|---|---|---|---|---|---|---|
| | 1934 | 1933 | 1934 | 1933 | 1934 | 1933 |
| | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* |
| ABERDEEN .. .. | 154 | 68 | 12,248 | 4,197 | 173,631 | 176,881 |
| ANGUS .. .. | 18,605 | 15,347 | 8,083 | 5,116 | 51,344 | 55,194 |
| ARGYLL .. .. | 14 | 37 | 698 | 528 | 13,363 | 13,918 |
| AYR .. .. .. | 1,984 | 1,046 | 90 | 39 | 31,791 | 33,117 |
| BANFF .. .. .. | 66 | 58 | 6,528 | 3,017 | 42,371 | 45,273 |
| BERWICK .. .. | 5,248 | 4,240 | 9,680 | 7,152 | 22,011 | 23,878 |
| BUTE .. .. .. | .. | .. | .. | 1 | 4,007 | 4,073 |
| CAITHNESS .. .. | 11 | 3 | 406 | 289 | 25,018 | 25,562 |
| CLACKMANNAN .. | 415 | 343 | 29 | 24 | 2,472 | 2,706 |
| DUMFRIES .. .. | 349 | 104 | 307 | 40 | 31,510 | 31,904 |
| DUNBARTON .. .. | 731 | 449 | 9 | 13 | 5,365 | 5,685 |
| EAST LOTHIAN .. | 8,753 | 7,606 | 11,670 | 9,917 | 11,574 | 13,548 |
| FIFE .. .. .. | 18,647 | 15,616 | 8,881 | 6,348 | 34,861 | 39,184 |
| INVERNESS .. .. | 256 | 195 | 3,061 | 2,662 | 27,593 | 28,004 |
| KINCARDINE .. .. | 3,094 | 1,951 | 4,550 | 2,331 | 29,640 | 32,103 |
| KINROSS .. .. | 566 | 368 | 120 | 74 | 5,712 | 5,789 |
| KIRKCUDBRIGHT .. | 351 | 131 | 14 | 16 | 18,610 | 18,255 |
| LANARK .. .. | 3,156 | 2,329 | 85 | 32 | 31,852 | 32,760 |
| MIDLOTHIAN .. .. | 6,874 | 5,990 | 3,115 | 2,063 | 16,298 | 17,896 |
| MORAY .. .. | 1,992 | 1,818 | 7,762 | 3,828 | 21,559 | 25,398 |
| NAIRN .. .. .. | 176 | 114 | 1,796 | 711 | 5,962 | 6,792 |
| ORKNEY .. .. | .. | .. | 2,405 | 2,481 | 29,815 | 29,959 |
| PEEBLES .. .. | 7 | 16 | 37 | 29 | 5,060 | 4,881 |
| PERTH .. .. .. | 13,141 | 10,115 | 1,498 | 710 | 55,828 | 57,831 |
| RENFREW .. .. | 2,065 | 1,598 | .. | .. | 7,165 | 7,683 |
| ROSS AND CROMARTY | 1,741 | 1,655 | 5,520 | 2,937 | 30,162 | 31,923 |
| ROXBURGH .. .. | 2,279 | 2,110 | 5,491 | 3,655 | 20,383 | 21,579 |
| SELKIRK .. .. | 4 | 3 | 92 | 25 | 3,295 | 3,272 |
| STIRLING .. .. | 3,189 | 2,162 | 309 | 111 | 14,247 | 15,342 |
| SUTHERLAND .. .. | .. | .. | 220 | 128 | 6,216 | 6,199 |
| WEST LOTHIAN .. | 3,471 | 2,789 | 1,046 | 779 | 8,747 | 9,487 |
| WIGTOWN .. .. | 288 | 125 | 69 | 46 | 23,272 | 24,072 |
| ZETLAND .. .. | .. | .. | 431 | 509 | 5,761 | 5,709 |
| TOTAL .. | 97,627 | 78,386 | 96,250 | 59,808 | 816,495 | 855,857 |

ACREAGE under POTATOES, TURNIPS and SWEDES and SUGAR BEET in each COUNTY on 4th June 1934, with COMPARISON for 1933.

| COUNTIES | Potatoes | | Turnips and Swedes | | Sugar Beet | |
|---|---|---|---|---|---|---|
| | 1934 | 1933 | 1934 | 1933 | 1934 | 1933 |
| | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* |
| ABERDEEN .. .. | 7,873 | 8,156 | 75,946 | 75,495 | 82 | 26 |
| ANGUS .. .. .. | 19,273 | 21,233 | 26,919 | 26,723 | 970 | 131 |
| ARGYLL .. .. | 2,291 | 2,486 | 4,290 | 4,368 | .. | .. |
| AYR .. .. .. | 8,235 | 8,880 | 6,589 | 6,512 | 16 | .. |
| BANFF .. .. .. | 1,669 | 1,707 | 17,669 | 17,681 | 13 | .. |
| BERWICK .. .. | 2,236 | 2,503 | 16,718 | 16,797 | 405 | 54 |
| BUTE .. .. .. | 932 | 1,022 | 1,157 | 1,100 | .. | .. |
| CAITHNESS .. .. | 998 | 1,032 | 9,518 | 9,586 | .. | .. |
| CLACKMANNAN .. | 372 | 399 | 702 | 671 | 1 | 1 |
| DUMFRIES .. .. | 2,843 | 3,149 | 13,835 | 13,470 | 14 | .. |
| DUNBARTON .. .. | 2,078 | 2,273 | 1,221 | 1,195 | 6 | 3 |
| EAST LOTHIAN .. | 7,894 | 8,716 | 10,248 | 10,458 | 577 | 109 |
| FIFE .. .. .. | 16,154 | 18,420 | 17,546 | 17,626 | 3,249 | 1,003 |
| INVERNESS .. .. | 4,239 | 4,535 | 8,097 | 8,111 | 69 | 6 |
| KINCARDINE .. .. | 4,338 | 4,770 | 14,163 | 14,033 | 173 | 32 |
| KINROSS .. .. | 1,189 | 1,335 | 2,190 | 2,102 | 37 | 7 |
| KIRKCUDBRIGHT .. | 1,259 | 1,317 | 8,341 | 8,032 | 7 | .. |
| LANARK .. .. | 6,274 | 6,894 | 8,759 | 8,469 | 8 | 2 |
| MIDLOTHIAN .. .. | 5,851 | 6,587 | 7,996 | 7,921 | 76 | 7 |
| MORAY .. .. | 1,644 | 1,717 | 11,848 | 11,938 | 478 | 135 |
| NAIRN .. .. .. | 276 | 296 | 3,486 | 3,435 | 71 | 19 |
| ORKNEY .. .. | 1,870 | 1,938 | 12,095 | 12,243 | .. | .. |
| PEEBLES .. .. | 325 | 339 | 2,435 | 2,322 | .. | .. |
| PERTH .. .. .. | 18,117 | 19,742 | 21,262 | 20,628 | 810 | 120 |
| RENFREW .. .. | 2,954 | 3,176 | 1,753 | 1,754 | 7 | .. |
| ROSS AND CROMARTY | 6,841 | 7,139 | 12,622 | 12,625 | 193 | 36 |
| ROXBURGH .. .. | 1,439 | 1,501 | 14,555 | 14,451 | 108 | 2 |
| SELKIRK .. .. | 128 | 144 | 1,868 | 1,816 | .. | .. |
| STIRLING .. .. | 3,221 | 3,572 | 3,439 | 3,225 | 38 | .. |
| SUTHERLAND .. .. | 922 | 942 | 2,316 | 2,333 | .. | .. |
| WEST LOTHIAN .. | 2,531 | 2,769 | 2,770 | 2,835 | 33 | 2 |
| WIGTOWN .. .. | 1,855 | 1,910 | 10,585 | 10,698 | 95 | 11 |
| ZETLAND .. .. | 1,877 | 1,914 | 1,006 | 1,000 | .. | .. |
| TOTAL .. | 139,998 | 152,513 | 353,944 | 351,653 | 7,536 | 1,706 |

## ACREAGE under RYE-GRASS and other ROTATION GRASSES and CLOVER, and under PERMANENT GRASS in each COUNTY on 4th June 1934, with COMPARISON for 1933.

| Counties | Rye-Grass and other Rotation Grasses and Clover | | | | Permanent Grass | | | |
|---|---|---|---|---|---|---|---|---|
| | For Hay | | Not for Hay | | For Hay | | Not for Hay | |
| | 1934 | 1933 | 1934 | 1933 | 1934 | 1933 | 1934 | 1933 |
| | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* |
| Aberdeen | 55,022 | 54,331 | 232,312 | 242,728 | 3,250 | 3,060 | 55,956 | 51,713 |
| Angus | 21,675 | 21,646 | 57,316 | 61,805 | 2,215 | 1,862 | 32,865 | 31,173 |
| Argyll | 11,330 | 11,584 | 13,384 | 14,114 | 15,152 | 15,717 | 49,787 | 49.137 |
| Ayr | 24,476 | 24,259 | 43,726 | 46,215 | 24,247 | 22,656 | 159,646 | 158,194 |
| Banff | 11,728 | 11,575 | 57,670 | 61,659 | 1,271 | 691 | 15,574 | 13,410 |
| Berwick | 12,887 | 12,172 | 47,519 | 51,822 | 4,055 | 3,051 | 63,959 | 64,914 |
| Bute | 2,228 | 2,228 | 5,171 | 6,352 | 493 | 587 | 11,472 | 9,811 |
| Caithness | 9,952 | 10,337 | 31,776 | 31,463 | 1,781 | 2,136 | 23,675 | 22,780 |
| Clackmannan | 1,065 | 993 | 1,529 | 1,669 | 1,155 | 1,193 | 6,776 | 6,550 |
| Dumfries | 19,497 | 19,978 | 46,259 | 48,515 | 19,746 | 19,291 | 104,604 | 102,937 |
| Dunbarton | 4,564 | 4,491 | 3,547 | 4,327 | 2,195 | 2,353 | 23,422 | 22,935 |
| East Lothian | 8,023 | 7,590 | 15,907 | 17,971 | 1,581 | 1,853 | 27,785 | 26,628 |
| Fife | 22,990 | 22,817 | 24,840 | 30,617 | 5,239 | 4,983 | 76.764 | 73,987 |
| Inverness | 11,619 | 11,401 | 21,188 | 24,228 | 10,155 | 10,461 | 55,803 | 56,423 |
| Kincardine | 12,519 | 12,116 | 34,554 | 35,229 | 884 | 895 | 11,732 | 12,594 |
| Kinross | 2,771 | 2,801 | 5,717 | 6,949 | 794 | 886 | 12,454 | 10,965 |
| Kirkcudbright | 10,864 | 11,156 | 36,763 | 40,230 | 13,196 | 13,661 | 86,891 | 82,746 |
| Lanark | 27,787 | 28,613 | 30,681 | 34,065 | 14,358 | 13,072 | 105,430 | 104,369 |
| Midlothian | 9,717 | 9,662 | 16,091 | 18,306 | 2,706 | 3,217 | 43,438 | 42,106 |
| Moray | 6,652 | 6,894 | 32,431 | 33,415 | 368 | 469 | 10,388 | 9,812 |
| Nairn | 1,654 | 1,883 | 8,509 | 8,607 | 18 | 279 | 2,824 | 2,656 |
| Orkney | 12,049 | 11,760 | 32,554 | 32,818 | 622 | 1,257 | 16,540 | 15,256 |
| Peebles | 2,469 | 2,454 | 9,360 | 9,677 | 1,778 | 1,830 | 27,030 | 27,591 |
| Perth | 29,359 | 29,267 | 56,536 | 57,447 | 12,771 | 13,354 | 101,359 | 103,475 |
| Renfrew | 6,795 | 6,960 | 5,636 | 6,161 | 5,900 | 5,532 | 43,863 | 44,241 |
| Ross & Cromarty | 12,885 | 12,283 | 33,548 | 33,567 | 4,144 | 4,266 | 27,130 | 29,611 |
| Roxburgh | 10,611 | 10,684 | 45,547 | 48,493 | 7,509 | 7,649 | 64,746 | 62,962 |
| Selkirk | 1,398 | 1,316 | 6,029 | 6,622 | 2,344 | 1,999 | 14,686 | 14,348 |
| Stirling | 9,052 | 8,801 | 9,174 | 9,534 | 8,085 | 7,882 | 55,601 | 55,929 |
| Sutherland | 4,386 | 4,509 | 5,679 | 5,927 | 1,691 | 1,785 | 9,032 | 8,576 |
| West Lothian | 5,936 | 5,722 | 3,753 | 4,525 | 1,506 | 1,299 | 22,114 | 22,380 |
| Wigtown | 8,113 | 7,394 | 47,739 | 50,396 | 7,037 | 7,364 | 52,234 | 52,038 |
| Zetland | 1,707 | 1,820 | 503 | 557 | 2,488 | 2,323 | 12,548 | 12,468 |
| Total | 393,780 | 391,497 | 1,022,948 | 1,086,010 | 180,734 | 178,913 | 1,428,128 | 1,404,715 |

## NUMBER of HORSES, CATTLE, SHEEP and PIGS in each COUNTY on 4th June 1934, with COMPARISON for 1933.

| COUNTIES | Horses * | | Cattle † | | Sheep † | | Pigs | |
|---|---|---|---|---|---|---|---|---|
| | 1934 | 1933 | 1934 | 1933 | 1933 | 1934 | 1934 | 1933 |
| | *No.* | *No.* | *No.* | *No.* | *No.* | *No.* | *No.* | *No.* |
| †ABERDEEN | 21,193 | 21,281 | 177,386 | 177,954 | 381,920 | 396,247 | 28,309 | 19,375 |
| †ANGUS | 7,023 | 7,115 | 55,262 | 56,210 | 201,725 | 208,754 | 10,736 | 8,824 |
| †ARGYLL | 3,964 | 4,039 | 51,693 | 51,159 | 718,808 | 725,158 | 4,030 | 3,639 |
| AYR | 6,860 | 6,893 | 124,472 | 120,423 | 420,610 | 413,053 | 13,201 | 10,598 |
| †BANFF | 6,261 | 6,169 | 42,354 | 42,276 | 108,283 | 109,081 | 7,037 | 5,498 |
| BERWICK | 3,386 | 3,353 | 28,017 | 27,333 | 384,231 | 403,549 | 6,816 | 5,146 |
| BUTE | 928 | 919 | 9,747 | 9,367 | 46,789 | 45,493 | 592 | 500 |
| †CAITHNESS | 4.178 | 4,152 | 20,904 | 20,197 | 201,506 | 193,917 | 1,572 | 1,147 |
| CLACKMANNAN | 484 | 439 | 4,285 | 4,427 | 12,450 | 12,652 | 836 | 625 |
| DUMFRIES | 5,261 | 5,247 | 81,631 | 77,316 | 593,916 | 590,652 | 10,742 | 9,309 |
| †DUNBARTON | 1,228 | 1,202 | 14,711 | 14,159 | 75,053 | 73,999 | 2,071 | 1,639 |
| EAST LOTHIAN | 2,620 | 2,628 | 17,228 | 16,870 | 146,334 | 160,367 | 4,116 | 3,970 |
| FIFE | 6,589 | 6,613 | 53,602 | 53,675 | 145,730 | 156,559 | 11,561 | 9,083 |
| †INVERNESS | 5,493 | 5,788 | 45,782 | 43,817 | 477,582 | 508,320 | 2,608 | 1,963 |
| †KINCARDINE | 3,548 | 3,579 | 29,813 | 30,652 | 71,396 | 74,632 | 4,495 | 2,806 |
| KINROSS | 789 | 781 | 6,974 | 6,732 | 36,043 | 33,246 | 1,038 | 847 |
| †KIRKCUDBRIGHT | 3,489 | 3,421 | 65,668 | 62,542 | 398,093 | 404,311 | 12,608 | 11,581 |
| LANARK | 5,739 | 5,631 | 79,135 | 77,508 | 256,249 | 246,573 | 8,629 | 7,880 |
| MIDLOTHIAN | 2,523 | 2,566 | 20,222 | 19,938 | 190,665 | 194,724 | 16,772 | 14,730 |
| MORAY | 3,377 | 3,412 | 23,513 | 24,379 | 50,000 | 52,351 | 5,130 | 4,022 |
| NAIRN | 974 | 990 | 6,927 | 6,732 | 13,784 | 15,736 | 1,184 | 974 |
| ORKNEY | 5,579 | 5,434 | 37,778 | 37,079 | 69,142 | 64,882 | 2,234 | 1,232 |
| PEEBLES | 660 | 645 | 7,715 | 7,416 | 199,054 | 206,789 | 685 | 588 |
| †PERTH | 8,739 | 8,780 | 75,091 | 76,770 | 629,437 | 654,054 | 9,813 | 8,472 |
| RENFREW | 1,931 | 1,879 | 27,524 | 26,595 | 46,868 | 47,413 | 5,745 | 5,125 |
| †ROSS AND CROMARTY | 4,887 | 5,141 | 36,707 | 37,161 | 332,591 | 337,888 | 4,719 | 3,345 |
| ROXBURGH | 2,962 | 3,000 | 27,815 | 26,723 | 564,536 | 581,754 | 3,771 | 3,149 |
| SELKIRK | 468 | 463 | 4,179 | 4,293 | 183,593 | 190,880 | 586 | 389 |
| STIRLING | 3,106 | 3,110 | 37,651 | 36,265 | 126,923 | 130,698 | 4,134 | 3,224 |
| †SUTHERLAND | 1,540 | 1,612 | 8,409 | 8,397 | 210,018 | 218,723 | 602 | 346 |
| WEST LOTHIAN | 1,484 | 1,521 | 14,763 | 14,205 | 23,630 | 25,988 | 3,049 | 2,701 |
| WIGTOWN | 4,003 | 4,046 | 65,324 | 64,346 | 151,769 | 153,458 | 16,705 | 14,165 |
| ZETLAND | 1,758 | 1,808 | 10,914 | 10,721 | 186,748 | 179,243 | 153 | 136 |
| TOTAL | 133,024 | 133,657 | 1,313,196 | 1,293,637 | 7,655,476 | 7,811,144 | 206,279 | 167,028 |

* Horses used for agricultural purposes, mares for breeding, and unbroken horses (including Stallions). "Other Horses" on agricultural holdings are not included; the total for these in Scotland is given in the summary table on p. 1.

† Including cattle and sheep grazed on Deer Forests.

DEPARTMENT OF AGRICULTURE FOR SCOTLAND,
EDINBURGH, 13th *December* 1934.

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# AGRICULTURAL ADMINISTRATION IN SCOTLAND DURING THE PRESENT REIGN

Sir ROBERT GREIG, M.C., LL.D., F.R.S.E.

DURING the reign of King George the Fifth, great and fundamental changes have taken place in the development of agriculture. The rapid conquest of the means of production by science has compelled a new outlook upon its future. Its framework has been completely altered in Russia and is undergoing radical changes in America and in many European countries. At this, the semi-jubilee of the King, when the Department of Agriculture has been in existence, first as a Board and then as a Department, for nearly a quarter of a century, it may be interesting and not without value to trace the development of administration in Scotland during most of the present reign.

The Department is one of the largest landowners in Scotland, owning 134 estates aggregating about 430,000 acres. There is scarcely a parish in Scotland where its activities are not in evidence, as landowner, as the agent for land settlement, as inspector of drainage schemes, of crops and of live stock. The Department owns or supplies nearly 1000 bulls and 900 rams per annum. It breeds Highland cattle and Highland ponies, and maintains stud farms and collecting stations for these purposes. It permits or refuses the importation or export of plants. It tests seeds and registers new varieties of crops. It certifies stallions and licenses bulls, and not least important, it distributes the funds for agricultural education and research which are provided by the Treasury and from other public sources.

The encouragement of agriculture by means of administration is no new thing. Sir John Sinclair of Caithness founded the first British Board of Agriculture in 1793. It died of jealousy in 1822. In 1889 a new Board of Agriculture was set up in Great Britain, but it was mainly concerned with the administration of regulations and with statistical and legal matters, and not specially with the development of agriculture. The Irish Department of Agriculture and Technical Instruction was created in 1900 under the late Sir Horace Plunkett. Then the dry bones began to stir in Scotland

and they stirred to some purpose. The age-old demand for land on the part of the landless had been partly satisfied, but only in the Highlands, by the Congested Districts Board which was established in 1898. The activities of the Crofters Commission which had been set up under the Crofters Act, 1886, for the purpose of fixing fair rents, were also confined to the seven crofting counties. The unsatisfied demand increased in the Highlands, spread to the Lowlands, and became a serious political question. This agitation coincided with a feeling of discontent on the part of Scottish farmers with the British Board of Agriculture, which was engaged in useful but mainly regulative work bearing no comparison with the work of the Irish Department. The Irish Department was inaugurating live-stock improvement schemes, widespread experiments in crop production, and a national system of education and organisation. Why, said the landless, should we not get land from the deer forests, the sheep grazings and the led farms ? Why, said the farmers, should we not get the facilities for live-stock improvement, and the advantages of agricultural education and research which Ireland obtains ? The outcome was the Board of Agriculture for Scotland, which was established under the Small Landholders (Scotland) Act, 1911, and began its career in April 1912 in a dozen rooms in 29 St Andrew Square. (The Board did not become a Department until 1929, but for convenience it will be referred to throughout under that name.) By the same Act the Land Court was established to replace the Crofters Commission, and its powers were extended to cover the whole of Scotland. Certain important duties in connection with the Department's land settlement schemes were entrusted to the Land Court.

**Land Settlement.**—The public, so far as they were interested in the new Department, were interested mainly in Land Settlement. This was natural, as there is scarcely any civilised country that is not alarmed by the steady depopulation of the rural areas and the unbalanced growth of industry. This phenomenon exists side by side in some countries with an insistent demand for land. Some years ago, for example, in one of the Australian States, when a large sheep farm was cut up into a dozen "family farms" under the State land settlement scheme, some thousands of applications were received and the balloting for the fortunate dozen occupied days. In the first nine months after the Department came into existence over 5000 applications for new holdings and enlargements were received, and those were strenuous days for the Commissioner for Small Holdings, as he was then called.

The provision of smallholdings by a Government Department is not a popular function. The Department is heavily handicapped from the beginning. Landlords, as a rule, do not welcome the change from a few large tenants to a large number of small ones, however liberal may be the compensation received for the change. Farmers, quite naturally, are not enamoured at the prospect of losing their farms, nor do the farm servants, in many cases, wish to look for a new job. As for the small holder and the applicant for a smallholding, the latter is disappointed when he does not get a holding, and for this he blames the Department, while the former, once installed, considers the Department responsible for everything that may go wrong except the weather. Finally, the public who are in favour of land settlement consider the rate of progress far too slow, and those who disapprove regard any progress as much too rapid. In short, the Department is attacked on all sides. Nevertheless, land settlement proceeded in spite of considerable and sometimes violent criticism, and of the almost insuperable difficulties caused by the safeguards inserted in the Act to prevent any shadow of injustice to existing interests.

During the war the staff of the Department became engaged in military and food production duties, and land settlement activities were greatly curtailed. But the end of the war released tens of thousands of service men for whom no immediate employment was available. This country in common with Canada, Australia, and New Zealand attempted to find room for many of these people on the land. Post-war land settlement schemes in some Continental countries were equally popular, and were set on foot in some places under drastic conditions of expropriation of the land. By the Land Settlement (Scotland) Act, 1919, the Department were empowered to buy land for settlement, and another Act enabled it to accept gifts of lands. At the instance of the Coalition Government the Department made the utmost endeavour to obtain land quickly to provide for the ex-service men, who received priority over other applicants. A greatly enlarged staff had hurriedly to be engaged. In a few cases land that would not have been considered in normal circumstances as suitable for settlement had to be bought, or scheduled for settlement, or sometimes accepted as a gift, to meet the pressure exercised both by public opinion and by the ex-service men. No time could have been more disadvantageous for land settlement from the economic point of view. The price of land, of sheep stocks, of building materials, and of every kind of equipment was at the peak. The price of money was also high and the Department had to borrow at 6 per cent or more. But the Government had no alternative if land settlement was to proceed. Some of the prices for sheep stocks then paid by the Department as fixed by reputable valuers were possibly among the highest ever paid, and these stocks had to be sold to the incoming holders at much lower prices. In order to proceed quickly with housing, large quantities of surplus war material were purchased, by no means suitable in all cases for permanent buildings. This was subsequently a source of annoyance to the holders and of trouble to the Department when roofs leaked and timber shrank or rotted. Yet there was no alternative ; to wait for land and good material meant slowing up land settlement for ex-service men which was not to be thought of at that time. The most urgent demands for land came from the Western Isles, where land was particularly difficult to obtain. Nevertheless, by purchase or otherwise, in a few years nearly all the available land in the Outer Hebrides and Skye came to be settled. The high costs of land settlement, owing to the causes of which some have been described, were apparent from the beginning, and it was recognised that apart from the normal burdens assumed by the Department, such as compensation to landlord and outgoing tenant and the provision of roads, fences and water supplies, still further concessions would be necessary. These consisted mainly of the transfer of sheep stocks to the holders at prices much below the prices paid by the Department, the holders having the option of paying for the stocks over a period of ten years with 5 per cent interest; loans for buildings by means of a terminable annuity including interest at 1¼ per cent; and rents fixed, not at a competitive figure or one directly related to the cost of forming the holding, but at the amount which the holder might reasonably be expected to be able to pay. These rents are subject to revision by the Land Court after seven years, and while this has resulted in some rents being lowered and a very few being raised, most have been maintained at or about the figure fixed by the Department. The loans for sheep stocks have on the whole been well repaid; out of £120,000 lent over £73,000 has been paid off. To meet the recent depression a moratorium has been offered on sheep stock loans for two years.

The grievances of the Highlands are apt to occupy so much public attention that the settlements in the Lowlands are sometimes overlooked. The difficulties here are of a different nature, but the results and prospects are more promising. The believer in the social value of a rural population will find much encouragement from the contemplation of the Department's settlements in many of the Lowland counties. In these can be found many men and women who have greatly improved their prospects and their standard of living. Some have moved to larger holdings and a few to farms. Very few have failed and abandoned their holdings, and still fewer have failed to better their conditions. In the Highlands, also, conditions have been bettered, but the prospects are not the same. The distance from markets, the cost of transport, the nature of the land and the limited area suitable for agricultural use combine to impose static conditions and stereotyped farming. In the Lowlands on the other hand the occupier of even five acres of land has a wide variety of possibilities. For at least a century the problem of maintaining the rural population in the Highlands has been urgent and sometimes apparently insoluble. It has been mitigated by drastic clearances. It has been ameliorated on the part of generous-minded landlords by reclamation, road-making, draining and afforestation, but it has not been solved. In the present reign it has been dealt with more humanely, more liberally and on the whole more successfully than in any previous period. But economic facts cannot be eluded, and the work of the statesman and the administrator is far from done.

What are the outstanding experiences of nearly a quarter of a century of administration of land settlement? In the first place, the original scheme embodied in the Act of 1911, viz., to leave the landlord in possession of his land, but, with full compensation, to impose upon him a number of smallholders in place of the existing tenants, has not proved satisfactory. It was assumed that many landlords were only prevented from forming smallholdings by the initial cost, and that if this were met, procedure would be easy. The war and the break-up of large estates altered the situation to some extent and land became more easily obtainable under the system of purchase introduced in 1919. It was found, too, that even with the goodwill of the landlord, which was by no means unusual, negotiations were complicated and procedure was slow. It was easier, quicker and cheaper to lay out a settlement on land of which the Department was the owner. Purchase has therefore been the general policy in recent years.

On the other hand, the disadvantages of ownership by a Government Department, from the standpoint of administration, became obvious. Within the limits of the law the private landowner is the arbiter when approached with a grievance by one of his tenants. Not so the Department; the final arbiter for a Government tenant is Parliament. The cost of administration of state-owned land is not comparable with that of the administration of privately-owned land; it cannot fail to be considerably greater. In many ways, the necessity of defending economy or justifying expenditure adds heavily to the burden of administration.

Another experience of administration is the difficulty of obtaining co-operative action on the part of a settlement of smallholders. A road handed over to a group of settlers in perfect order and under a signed agreement by them to keep it in order will sometimes be neglected until it becomes impassable, and then there is a complaint that their children cannot get to school. The Department is blamed, something has to be done, and in the end the taxpayer may have to pay twice over for the road. Similar difficulties arise in the group management of water supplies.

Experience shows that some ingenious holders can benefit from the settlement scheme while ignoring the principles, and that it is difficult and expensive to evict a smallholder who, while paying his rent, is not making reasonably good use of the land. These cases are exceptional and cannot be avoided, but they naturally receive a publicity disproportionate to their numbers.

Another somewhat unexpected experience is the desire on the part of the Department's tenants in the Lowlands, expressed on more than one occasion, for ordinary farm tenure instead of the more elaborate landholder's tenure which gives ownership of the buildings. Administration from the beginning has proved to be full of surprises, pitfalls and difficulties, but with the passing of time these troubles have generally come to be foreseen, and so far as possible provided for. Now, owing to the desire for efficiency which is not absent even from a Government office, under the unrelenting demands for economy, through the examination of every means of improvement, and through the lessons of experience, the *method* of land settlement has so developed that it is not easy to see how under existing conditions it can be improved. Policy and results are different matters. With regard to the results, a Committee appointed by the Secretary of State in 1927 reported to Parliament in 1928 and their findings are available to the public.[1] The number of applicants settled up to 31st December 1934, was 6,448, being 4,453 on new holdings and 1,995 on enlargements. The total area comprised in the holdings and enlargements formed by the Department is 623,398 acres.

**General Development of Agriculture.**—When agricultural administration began in Scotland in 1912 the Agricultural Colleges were firmly established and were doing good work, while the Congested Districts Board were endeavouring to improve the live stock in the Highlands under the management of Mr Mackintosh, but with these exceptions little was being done. Live stock being the primary agricultural product in Scotland it was natural to start with them. The Congested Districts Board in 1912 owned and supplied to Crofter Committees 245 bulls and gave premiums for 14 others. They also owned a fold of Highland cattle numbering 55 and a stud of Highland ponies, and they owned and lent out to crofters 470 rams at a fee of 10s. each for the season. On this nucleus the Department built up and extended the live-stock improvement schemes. The number of "supply" bulls as they are called, *i.e.* those owned and supplied by the Department, has only slightly increased since those days from 270 to 290, but the premium bulls have increased in number from 14 to 652 and the rams from 470 to 900. The experience of twenty-three years leaves no doubt as to the benefit derived from these schemes. The level of cattle and sheep has much improved and where premium bulls have been used for many years the high prices now obtained for young stores, as at Aberfeldy, are sufficient proof. Better shapes, greater weight of wool and earlier maturity have followed the introduction of the Government rams. There is still a demand for Highland cattle in the remote west, and as the pedigree breeding of these cattle is in few hands and one may believe chiefly as a hobby, it is necessary for the Department to eke out the supply by becoming a breeder of pedigree stock. In the same way the supply of Highland pony stallions from private sources is not enough and a Highland pony stud has therefore to be maintained at considerable expense. It may be argued that breeds that cannot afford to pay for bulls and stallions are redundant and should be left to die out. It is claimed, however, that the Highland cattle and Highland ponies are not yet replaceable by other breeds, and that neither the crofters nor the shooting tenants who require the ponies for stalking can afford to breed the stallions. The general principle of giving assistance, not to individuals, but only to properly constituted Live Stock Improvement Committees or Common Grazings Committees has proved to be sound. The Bulls Premium Scheme has enabled the Department by administration to encourage the breeders of the better-quality pedigree animals and to stimulate the eradication of tuberculosis, though only to a limited extent, by refusing premiums to bulls not certified free of the disease.

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[1] *Report of the Committee on Land Settlement in Scotland*, Cmd. 3110, 1928.

Horse-breeding has been encouraged by the registration of stallions as being free from certain hereditary diseases and fit for breeding. The registration, originally on a voluntary basis, is now compulsory, and it has been the means of eliminating the conspicuously inferior sires that travelled for small fees and battened upon the small farmers and smallholders. Grants were also given until recently in payment of part of the service fees of approved stallions serving the mares of small farmers. The Shetland pony has not been neglected and approved stallions of that breed receive grants. At one time the Department administered the Light Horse Breeding Scheme in Scotland, but that with other activities of less important character has been discontinued partly on the grounds of economy. Although horse-breeding is more or less a dying industry, a certain number will be required for some time to come, particularly by the railway companies and transport contractors, and if the benefits of the Horse Improvement Schemes are less obvious than in the case of cattle and sheep they are nevertheless substantial. Scotland until recently has never taken much interest in the pig industry, but the Department has always encouraged better pigs by offering premiums for approved boars. Even goats are not forgotten and a small sum is disbursed every year for their improvement. The organisation required to collect and distribute hundreds of bulls and rams every year, and to maintain them in the off season is considerable. To facilitate this work and to provide for the Highland cattle and the Highland pony stud three farms are occupied by the Department in the neighbourhood of Inverness. It is interesting to note that two abortive attempts were made to improve Shetland cattle, a good milking breed and said to be free from tuberculosis but much in need of improvement, and to grade up the Shetland sheep, also greatly in need of attention. A herd of cattle and a flock of sheep were maintained for some years and remarkable results were obtained by crossing the Shetland sheep with Soay and Siberian strains. The weight of fleece, the most valuable of British wools, was nearly doubled without any depreciation of quality. This promising experiment with these breeds came to an end with the fall of the economy axe. Before passing from the improvement of the domestic quadrupeds, mention must be made of the Licensing of Bulls Act. Legislation to prevent the use of inferior sires had been in operation in some countries for many years, and the Irish Free State and Ministry of Agriculture in Northern Ireland had demonstrated both the benefits and methods of procedure before the Scottish Department was able to take action. A substantial body of Scottish opinion had been favourable for years to the elimination of inferior bulls. It was considered, however, that legislation must apply to the whole of Great Britain, and the stumbling-block was the unwillingness of the English farmer to subject his live stock to public criticism. The Act came into operation in Scotland in 1932 and in England two years later. Although Scottish cattle probably need less improvement than most, there can be no doubt that a definite grading up of the average will occur. It is only unfortunate that so many valuable years have been lost. Doubtless in time control will be exercised over boars and rams in similar fashion.

The most scientific or highly developed branch of agriculture is poultry-raising and egg-production. While the rapid improvement has been due mainly to the industry itself, supported by the Agricultural Colleges and Research Institutes, the Department has been of unquestionable assistance. In 1912 the scheme was simple and elementary. A bonus was given for the distribution of eggs of pure breeds and a 50 per cent grant was made towards the cost of a suitable house and approved stock. To this were added after a time grants for trap-nesting. In 1924 an official egg-laying testing station was set up near Edinburgh, which has been in full use for ten years. To the bonus to approved stations and to the trap-nesting have been added grants for blood-tested breeding stock. The general effects of this administrative assistance, allied with the other factors mentioned, are shown in the gradual disappearance of the mongrel fowl, the higher average individual egg production and the great extension of poultry-keeping in Scotland.

Shortly after the formation of the Department, at the instance of farmers and seedsmen, a seed-testing station was set up, and none too soon. Scotland was the last but one of the civilised countries to organise an official seed-testing station. England followed suit a few years later. The fine modern buildings at Corstorphine are not only used for seed-testing, but provide accommodation for the laboratory tests of new varieties of potatoes and for many minor investigations. The farm is the site of demonstration plots consisting of many hundreds of varieties of potatoes in all stages of health and disease. These plots are used for the intensive training of the potato inspectors to the number of a hundred or more annually. The farm is also used for the trial of new varieties of farm crops with a view to their official registration if they satisfy the conditions stated below.

The exportation of seed potatoes is an important part of arable farming. The desirability of maintaining the reputation of Scottish seed potatoes was obvious. In 1918, after consultation with farmers and the potato trade, a scheme was inaugurated for the inspection of growing crops of potatoes with a view to the issue of certificates and reports as to purity. It appealed at once to seed-growers, and now about 55,000 acres are inspected annually. It was found, however, that a report upon health or absence of disease would make the certificate more valuable and stimulate the elimination of disease. Potatoes are now inspected under seven grades, and it is notable that in 1934 only about 1,500 acres out of 55,000 were placed in the lowest grade. A system of certifying "stock seed" is also adopted. Stock seed must be 100 per cent pure and free from certain diseases. A further refinement of "stock seed" is the "built-up stock" specially selected for farmers, the growth of which is supervised and inspected in conditions that preclude contamination. This method of improvement by inspection and certification has enhanced the reputation of Scottish seed. Indeed France and Germany which used to be large exporters to South Africa have lost the market, which has been gained by Scottish exporters. The scheme has the additional merit in the eyes of the Treasury of costing nothing to the Exchequer.

The registration of new varieties of farm crops is one of the functions of the Department. The chief applications are for potatoes and oats. All varieties submitted for registration undergo rigid testing over a period of years and must satisfy the Committee of experts that they are new, and that in the case of cereals they are superior to existing strains; in the case of potatoes the requirements are that they are immune from wart disease and are at least equal in quality to existing varieties. A preliminary laboratory test is made in order to inform potato-breeders at an early stage whether their varieties are immune. The volume of this work may be gauged from the fact that nearly 700 tests of single tubers were made in 1934.

**Agricultural Education and Research.**—A description of the progress of agricultural education and research during the past twenty-five years would require a volume to itself. The subject was fully dealt with in this *Journal* ten to twelve years ago.[1] It is sufficient to review briefly the salient features of its development. The financial responsibility for the Colleges was taken over from the Scottish Education Department in 1912. Since then the work of the Colleges, particularly the advisory and extension work, has greatly increased. There is now no part of Scotland for which some county organiser is not responsible. Every farmer in Scotland is entitled by right to call on the local Agricultural College

[1] Alex. M'Callum, M.A., LL.B. "Agricultural Education in Scotland" (four articles), *Scot. Jour. of Agric.*, vol. vi. (1923). "Veterinary Education in Scotland," *ibid.* vol. vii., p. 45 (Jan. 1924). "Agricultural Research in Scotland," *ibid.* vol. viii., pp. 14 and 163 (Jan. and Apr. 1925).

for whatever knowledge and advice may be available to assist him. Dairying and poultry-keeping are provided for through itinerant instructresses and there can be no question as to the benefits which have resulted from their activities. In addition to the central classes for Degree and Diploma students and in addition to the County work, the experimental farms which are attached to each College are of great teaching value. By demonstrating methods of crop cultivation, the proper use of fertilisers and the modern knowledge in regard to stock-feeding, they are also of much use to farmers. While all have taken part in the grading up of farming, there may be attributed to the Aberdeen College, the excellence of the pastures in the North-East of Scotland, now at least 50 per cent better than they were thirty years ago; to the Glasgow College, increased milk production and better feeding methods; and to the Edinburgh College, high-class arable farming, especially in the production of potatoes and grain. Each has learned from the other and each has been successful in one or other line. The cost of maintaining the Colleges has risen from about £37,000 in 1913 to over £78,000 in 1933. Numerous donations have been made to the Colleges, the most outstanding of which is that of Mr Hannah, who, in presenting the Estate of Auchincruive, enabled the Governors of the West of Scotland College to acquire and erect the finest farm buildings and equipment for their purposes in Great Britain.

When the Department began in 1912 there were no research stations in Scotland. The foresight of Mr Lloyd George had provided a Development Commission and a Development Fund from which assistance could be obtained. The first call upon the Fund was made for an Animal Nutrition Station in Aberdeen. A small building had just been erected and work had begun when the war broke out and all such developments were postponed. After the war it became possible through the generosity of the late Dr Rowett and others to establish the Institute on a more ambitious scale. Later Mr Duthie Webster provided substantial funds for an experimental farm, Dr Reid for a library, and Lord Strathcona and others for a residential club for the staff and students. These generous benefactions were supplemented by State grants for capital purposes, amounting in all to more than £80,000. Under the control from the first of Sir John Orr the Rowett Institute has greatly advanced the science of nutrition and the practical knowledge of animal feeding. The next research station to appear was started by Dr (now Professor) Crew in the cellars of a disused hospital in Edinburgh. From this small beginning has grown the Institute of Animal Genetics, situated with other departments of the University of Edinburgh at King's Buildings, while an experimental stock-breeding farm has been established near Balerno. The Empire Marketing Board, the Rockefeller Institution and Dr T. B. Macaulay of Montreal have made these developments in animal-breeding research possible. The prevalence of animal diseases and the absence of concerted attempts to eradicate them had engaged the attention of farmers for some years, and the Animal Diseases Research Association was formed in 1920. The Department was approached with a request for assistance and willingly complied. Later, gifts were received from Mr Falconer Wallace and others, and land and buildings were acquired at Moredun, near Edinburgh. This Institute has already made marked progress in the elimination of some diseases and in the investigation of others.

Mr James Elder and Mr David Bell, in association with other seedsmen and farmers, had long felt it a reproach to Scotland that no institution existed devoted to the science of plant breeding. On being assured of the Department's help if sufficient evidence were given of a real demand for such a research station, Mr Elder and his friends succeeded in the noteworthy feat of raising over £22,000. This sum, with an equal sum contributed by the Department, originated the Scottish Society for Research in Plant Breeding, with land and buildings at Craigs House, Corstorphine, from which new strains of oats and potatoes have been put upon the market. Scotland was now provided with research stations for Animal Nutrition, Animal Breeding, Animal Diseases, and Plant Breeding. It fell to Mr Hannah of Girvan Mains, by his gift of the Estate of Auchincruive, to give the impetus to the initiation of a Dairy Research Institute. After much discussion and negotiation it was started at Kirkhill, near Ayr, and is now in full swing and engaged in important work under the direction of Dr Norman Wright. The youngest station up to the present date is the Macaulay Institute for Soil Research at Aberdeen, the foundation of which was originally due to the interest taken by Dr T. B. Macaulay in the possibilities of land improvement in the island of Lewis. Through Dr Macaulay, an area of useless moorland was obtained at Arnish, near Stornoway, and under the control of Dr Ogg new methods of managing peat land have been discovered and demonstrated. Extending his interest to the mainland Dr Macaulay provided funds for the purchase of land and buildings and largely equipped the Soil Institute at Craigiebuckler, which is now at the beginning of its career.

The Agricultural Colleges, in addition to the central and county staffs, have appointed advisory officers who investigate local problems and advise farmers on subjects of special importance in the College area, while the Department has appointed a plant pathologist to carry on advisory and research work.

It may now be said that nearly all the aspects of Scottish agriculture are the subjects of research. Economics are provided for in the Colleges and in the Department itself; the College advisory officers co-operate with the Department in the general investigation of the profitableness of farming, in addition to their local work of teaching, advice and investigation. For research in machinery reliance is placed largely on the Agricultural Engineering Institute at Oxford. It is safe to say that no other country of similar agricultural population is so well equipped for research or so well staffed with competent scientific men and women. This is due in the main to the Scottish farmers and merchants who have contributed money, energy and time to show their appreciation of the permanent utility of research. The role of the Department has been that of supervisor, financial agent and go-between. It has done nothing avoidable to stay or frustrate the development of agricultural education and research, and it has a right to share in the high repute with which the institutions dealing with these subjects are regarded both at home and abroad.

**Economics, Statistics and Intelligence.**—An important branch of the work of the Department and one that will become increasingly essential is that dealing with Economics and Statistics. It is becoming more obvious year by year that statistics are the main tools of the craft of administration and that the trained economist is required to interpret them. The Department has since 1912 collected the various agricultural returns, including the essential June returns, and has issued reports on two Censuses of Agricultural Production. The information required for the June returns is now more extended and elaborate than ever before. It is on the basis of statistics that policy is, or ought to be, founded and so more knowledge, not less, is required. But the mere collection of data without a plan is not always enough, so economic and statistical investigations are made. Such is the Investigation of the Profitableness of Farming conducted by the Department since 1928. The results of this investigation become increasingly valuable every year and though they are a record of the past they are a guide to the future. The economists of the Agricultural Colleges assist the farmers who provide the accounts for the investigation. That their assistance is appreciated, and that the value of the keeping of accounts is realised, is shown by the fact that the number offering their accounts has increased by nearly 50 per cent since 1928.

**Agricultural Drainage.**—Grants for the assistance of drainage have been made since 1921 on terms which have varied from time to time. Under the stimulus of these grants great areas have been improved. The totals of 61,800 acres of arable and 1,239,000 of hill land are impressive and suggest a considerable increase in the productive capacity of the arable land and improved health of the sheep stocks. The total sum allocated in these years amounts to £235,000. The Department were empowered by the Land Drainage (Scotland) Act, 1930, to undertake drainage schemes on a larger scale, dealing with rivers that caused the flooding of agricultural land. So far, only one scheme has been undertaken—the removal of the obstruction caused by the Dormont Rocks to the flow of the river Annan.

**Public Works and Transport.**—The poverty of the Highlands and Islands and particularly of the Congested Districts, was the reason why the Congested Districts Board had power to expend money on such public works as roads, piers and harbours. The Department succeeded to this duty, and since its inception has spent £155,000 on such works. Nearly half the parishes in the Congested Districts can show a pier, harbour, road or footpath constructed, contributed to or paid for by the Department. The annual sum available for these purposes is limited, but the local demands are practically unlimited, so it will take some time to equip about one-third of Scotland with all it demands or desires of these amenities, but the numerous piers that could not be provided from local resources, and the scores or hundreds of miles of roads leading from one remote settlement to another, are evidence of the general desire on the part of the community to ameliorate the conditions in the Highlands. For some years a small steamer was chartered by the Department to ply to and from the less accessible lochs and bays not usually visited by the regular services. Circumstances seemed to justify the discontinuance of this facility except for special arrangements at Loch Torridon, and now transport services are confined to grants for certain steamer trips in Orkney and a motor-boat service for the Island of Soay.

**Loans for Crofting Housing.**—One of the achievements of the Department, the provision of improved dwelling-houses by means of loans for crofter housing, cannot fail to meet the eye of any who have been familiar with the Highlands and especially the Hebrides during the last twenty years. Although there are still many " black " houses blotting the landscape their numbers are declining, and few are left in which cattle and people are housed under the same roof. In some settlements the " black " house has completely disappeared. During its existence the Department has lent over £310,000 for the erection of new dwelling-houses and the improvement of existing ones. This sum includes a small proportion for the erection or improvement of steadings. The Department has also sold building materials to the value of £240,000 to landholders who were able to do without loans.

**Women's Rural Institutes.**—During the last years of the last century there arose a spontaneous growth of opinion among country women in different parts of the world that their common interests might be organised in some form. Beginning in Canada in 1897 the movement spread to the continent of Europe and eventually reached this country. The formation of Women's Rural Institutes had been publicly suggested in 1912, but the first English Institute was organised in 1915 and the first Scottish Institute in 1917. The history of the Institutes has been fully described elsewhere.[1] The Department took a prominent part in their establishment, and for five years was responsible for their organisation, in which a chief organiser and three assistants were employed. The success of the movement being assured the official administration and supervision were withdrawn and under their own government, and almost entirely self-supported, the Institutes now number 967 with a membership of about 50,000. The rise and development of the Women's Rural Institutes is the most important social event of the present reign. No doubt they would have established themselves in face of all difficulties, but the Department had the satisfaction of rendering valuable assistance in the early stages of the organisation.

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[1] J. W. Robertson Scott, *The Story of the Women's Institute Movement* (Village Press, Idbury, Kingham, Oxon.), 1925.

**Miscellaneous.**—The duties of the Department include many other aspects of administration too numerous to mention. Among them are the control of destructive insects and pests, the destruction of injurious weeds and of rats and mice and, more recently, of musk rats. The regulation of heather-burning, the certification of plants for export and the inspection of imported plants are part of the miscellaneous but necessary work. One of the most recent administrative developments is concerned with grading and marking under the Acts of 1928 and 1931. Eggs, tomatoes, ware potatoes, canned fruit and malt products are graded and marked, but are less striking in their results than the marking of beef which has been in operation for some time. In 1933 no less than 60,000 sides of beef were graded and marked, while 1700 were graded but unmarked.

The pioneer of organisation in Scotland, the Scottish Agricultural Organisation Society, has been supported throughout by the Department and the Scottish Milk Records Society has been similarly assisted.

In no previous reign has the control of agriculture and industry been so rapidly extended, and yet, administrative control may impinge further upon what has been the normal management of a farm. The principle of the Marketing Acts has come to stay in some form or other. The future, therefore, is not one of laissez-faire for the farmer or of quiescence for the administrator. What form future administration will take is an interesting but fruitless speculation. Looking back over twenty-three years of administration it would appear that within the limits of the funds available, and keeping in mind the legislation by which it has been controlled, the Department of Agriculture for Scotland has been a potent instrument in the development of Scottish agriculture.

# THE ERADICATION OF BRACKEN BY CUTTING

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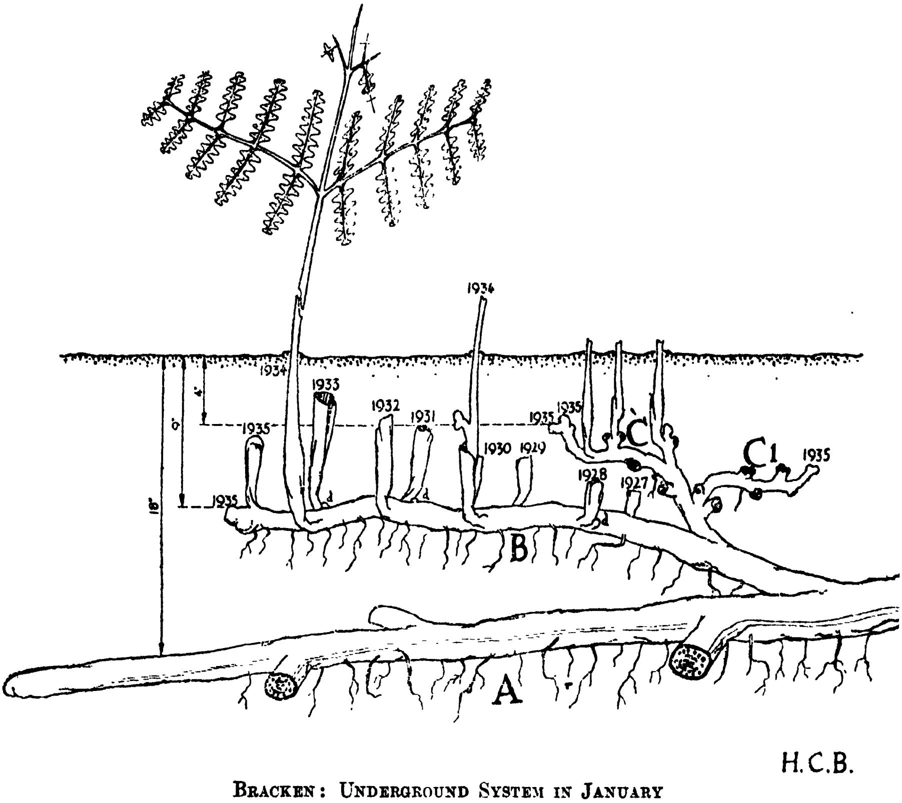
That bracken can be exterminated by cutting is generally admitted, but great differences of opinion exist as to the number of cuttings required, owing partly to the many different habitats in which bracken is found and partly to the interpretation placed on the word " extermination."

The bracken plant consists of a bulky underground system which extends for many dozens of square yards. Many a patch of bracken is in fact one extensive plant annually producing hundreds of fronds. Possibly even large bracken areas are all one plant, so it is obvious that the whole must be attacked as a unit. Under ideal conditions of good deep soil the subterranean system can be shown to be made up of three or more tiers of rhizomes or underground stems. The lowest tier—the leader—usually runs at a depth of 15 to 25 inches and is the main invading system. It possesses the thickest rhizomes ending in a terminal finger-like bud which periodically produces side buds to right and to left. This is figured in the diagram as A. The side buds develop into branches which bend upwards and move horizontally in a region above, and if they are within 9 inches or less of the surface often bear fronds (B). They also produce subsidiary buds which grow into much thinner, shorter branches, often characteristically zigzagged (C and $C_1$). These approach nearer to the surface and frequently produce fronds in groups. The proportions in which these tiers are produced depend on soil depth and texture and the food ingredients available. Given friable soil of good feeding quality, tiers A and B are abundantly produced, while if conditions are such as to check these, C develops most. Near the periphery of an area A and B are most abundant and tier C commonest about the centre. If for any reasons the depth of soil decreases, as for example when the subsoil or a rock approaches within 7 to 9 inches of the surface, all these zones get compressed into one layer overlying the subsoil, but the downward tendency of the terminal bud on A is such that if it reaches deeper soil three (or even four) tiers will again be exhibited. In all cases the terminal bud of each tier is the most actively growing bud. By the division of its terminal cell it gives rise to lateral buds which produce either branches or fronds. These may produce buds which may lie dormant for some years. Normally the fronds of each season arise from the side buds immediately behind the terminal buds of tiers B and C, but sometimes subsidiary buds may also develop at the base of these. If the frond is destroyed in the green state, the bud destined for next season's frond begins to develop and in addition some of the dormant buds or subsidiary buds develop into fronds.

The zonation of rhizomes is very important to the plant, for during summer it requires a good water supply for the elaboration of its food supplies and in order to make up the water lost by transpiration. Water is drawn in by means of the root system and along with it (in solution) the various minerals. The upper tiers are apt to suffer damage during hard frosts or severe droughts,



H.C.B.

BRACKEN: UNDERGROUND SYSTEM IN JANUARY

A. Main elongating rhizome.
B. Large branch bearing fronds from near apex.
d. Dormant buds. The remains of 1934 fronds extend to surface; those of previous years in various stages of decay. In one case a branch from a dormant bud had grown through an old frond-base.
C. Branch of limited growth; fronds as in B.
$C_1$. Except at end only leaf-scars are depicted.
r. Roots.

but the deeper system allows the plant to survive. Moreover, in dense herbage the lower system permits it to advance comparatively easily and to send up its fronds wherever possible. It thus extends beneath heather. If old heather is destroyed by fire the uninjured, deep-seated rhizomes seize the opportunity to produce branches which can now easily force many fronds to the surface and quickly colonise the area. This fact also explains why bracken in "extended order" advances so rapidly into good herbage.

The fronds shade the herbage and thin it; more fronds can then be pushed in until the herbage is subdued. The deep rhizome also explains the presence of bracken in arable fields in light soil, *e.g.* in Moray.

The bulk of bracken rhizome may be enormous—five or even ten or more feet of it lying below each square foot of surface. This is packed with food reserves such as sugar and starch. All these food reserves were manufactured in the fronds from carbon dioxide obtained from the atmosphere and from water containing mineral salts derived from the soil.

The removal of the fronds therefore (*a*) prevents the building up of further foodstuffs and (*b*) exhausts the underground reserves by inducing attempts to produce new leaves. Theoretically (and this is backed by experiment), the best time to destroy fronds is when they have just reached their maximum growth, *i.e.* when they have drained the rhizome but have not begun to contribute food. This period is from the middle of June to early July. Obviously large areas cannot be cut in a short time, and as the fronds are easier to cut before they harden, it is better to cut early, although with early cuttings more fronds will subsequently arise during that season than with cuttings where the fronds have completely uncurled.

Economics govern the method adopted for destruction. The scythe is the commonest implement. Mr J. H. Milne Home [1] gives a table of the number of cuttings required and their costs for the South-East of Scotland. He states that a competent man would scythe two to three acres per day (depending on the nature of the soil and density of frond) and that the contract rate per acre works out between 2s. 9d. and 3s. 6d. per cut. The Collins Motor Bracken Cutter and the Pugh Welsh Bracken Cutter are equally effective on most lands and it is claimed that they cover approximately an acre per hour. On land free from stones more could be done by breaking the fronds in the brittle "curled state" in May by means of a chain harrow or even a tree-top dragged over the surface. On steep or stony places hooks and switches can be used. In all cases *two or more* cuttings are required for the first year or two with an interval of 5 to 6 weeks between the cuts.

The secret of success lies in the systematic destruction of the fronds until the plant is starved to death. A cessation of cutting is comparable to leaving a forest fire smouldering. The time necessary for extermination varies with the soil conditions and development of the subterranean portions. In exceptional conditions three years may suffice, but more usually it is nearer five in the East of Scotland and often more in the West. During the second year the number of fronds produced is sometimes greater than in the previous year, but they are considerably smaller and by the third year there is a noteworthy decrease in number and in size.

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[1] "The Eradication of Bracken," *Scot. Jour. Agric.*, vol. ix., p. 123 (April 1926).

I wish to acknowledge my indebtedness to Mr H. C. Berneaud for preparing the diagram from my sketch, and to authors and helpers mentioned in my previous papers on bracken in this *Journal.*[1]

# THE MANAGEMENT OF LABOUR

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After land, labour is the most fundamental thing in farming; indeed, under most systems of agriculture it is the largest item in the cost of production. In primitive communities and in countries where farmers are mainly self-sufficient, working to supply the needs of their families rather than of the market, the cost of labour, however great, is not measured. But wherever the industry is commercialised and goods must be produced for sale in a competitive market, labour costs become at once of first importance. Indeed, their influence on the prosperity of agriculture varies directly with the extent to which it is commercialised. In districts such as the prairie provinces of Canada, where wheat is the only product and everything which the farmer needs must be bought out of the proceeds of his wheat sales, his success is relative to his efficiency in the use of labour, both his own and hired. In countries where mixed farming is practised and the household derive some part of their subsistence from the land upon which they live, as in most European countries, efficiency is still important for it determines the cost of the marketable surplus. But the importance declines as the proportion which saleable production bears to home consumption declines, until we reach those communities who are entirely self-sufficient.

In Britain, farmers for the most part are engaged in production for a market in competition, hitherto, with farmers from all the world. Now, if labour conditions in the competing countries resembled those which prevail in Britain, the management of labour in this country would hardly challenge the farmer's skill. He has inherited a soil which centuries of cultivation have brought to a high pitch of fertility, he has a climate favourable to the growth of crops and grass, and his market is almost at his back door. But a very little consideration shows that conditions of employment at home differ very widely from those in almost every country in the world, and it is these differences which make the management of labour a thing of the first importance in the success of British farming. Agriculture, the world over, is a small-scale industry. Except in some of the meat-producing districts of South America and Australasia and in the plantation industries (tea, coffee, rubber, etc.) which do not compete with British agriculture, farming is almost everywhere organised in land units which can be handled by the labour of the farmer and his family. This is true whether the unit be one of a few acres cultivated almost entirely by manual labour, as in some of the peasant states of middle Europe and the East, or whether it extend to several hundred acres cultivated with a tractor and a harvester-thresher, as may happen in the prairies. The wages of these family farmers are no fixed sum payable in good times and bad, for they fluctuate with the value of the net output of their farms. The hours of labour are uncontrolled except by their own inclination. Social services such as have been developed in Britain, and for which the land must pay its share, are largely unknown. Even where farming of this type calls for the employment of hired labour, it is mostly seasonal and it does not bulk in the general economy of production.

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[1] "Bracken as a Colonist," *Scot. Jour. Agric.*, vol. xvii., p. 59 (Jan. 1934). "History of the Bracken Disease," *ibid.*, p. 297 (July 1934). See also "Control of Bracken in Scotland," *ibid.*, p. 221 (Apr. 1934).

By contrast with conditions such as these, and again it must be said that they are the conditions prevailing in most parts of the world, farming in Britain is dependent upon the use of hired labour. In this country, for example, there are nearly three hired workers to each farmer, while in the United States the ratio is almost exactly reversed. Now, it is common knowledge that changes in wage rates lag behind changes in the price level, so that in times of falling prices such as those through which the world has been passing in recent years, British farming has been faced with a difficulty which its competitors have been able to resolve more easily, even though both are competing for the same market. For the British farmer the problem has been how to pay a fixed labour bill out of a declining revenue ; for his competitor the problem, while serious enough, no doubt, has meant no more than the adjustment of his standard of living to a falling income. In other words, a falling price level is countered automatically in a community of family farmers by a falling standard of living ; in the capitalist agriculture of Britain, the standard of the hired labour upon which the system so largely depends has to be maintained, anyhow for a time, notwithstanding a fall in the value of the products of that labour.

The situation compared with other countries is aggravated, too, by comparisons with other industries. In Britain, the remuneration of the hired farm worker has always been held to lag behind that of the worker in industrial employment, although the difference may not be so great as that which is sometimes claimed. But public opinion, for a long time, has been at work to bring the rates of wages and the hours of labour on the land more into line with those in the towns, with the result that, in England, hours of labour and rates of pay are now controlled by statute, while in Scotland, collective bargaining has secured conditions of labour not less favourable for its agricultural workers.

It is at once apparent that the item of labour in the total cost of the product would be very much higher in British agriculture, if farming in this country were conducted under a system of labour organisation similar to that in competing countries, and it follows that only by the adoption of other methods of management designed to raise the efficiency of the labour employed can the British farmer expect to maintain his position in an open market.

**The Family Farmer.**—In Britain, every type of farm organisation is to be found. The life of the Scottish crofter resembles, in its essentials, that of the peasant in many European countries. He is farming to satisfy his own needs by the direct products of his labour. Purchasing power is a term which has little meaning for him, and his standard of living is measured by the volume of his production. In other parts of the country a different type of family farmer is found in large numbers. Although they are self-suppliers in varying degrees, all of them are producing for the market—it may be milk, store stock, or market-garden produce. Their standard of living, in material things, is determined by the value of their saleable surplus, so that whereas, to the crofter, changes in the price level have little meaning, this other type of family farmer is directly affected by them. For both, however, labour as a subject for management, presents no problem. Work, hard work, and work all the time is the beginning and the end of it. Measured in terms of material wealth, their position may be better or worse than that of the hired worker, for it fluctuates with the market price of the commodities they sell. But if the hours of their labour are valued at the rates at which the hired worker is paid, their labour management often makes a poor showing.

A study of the remuneration of labour applied by the family on a group of 132 holdings not exceeding 50 acres, in Carmarthenshire, showed that whereas the income of the family fluctuated between £81, 15s. 3d. and £106, 3s. 1d., it represented in cash earnings per man no more than from £42, 2s. 11d. to £51, 15s. 8d. per annum. The figures relate to a group of mixed farms in a lowland district, and they contrast with a statutory wage of some £78 per annum earned by the hired farm worker in the same area.[1]

It follows, of course, that their standard of living when measured by other than material things, such as the opportunity for leisure and the enjoyment of it, is low, and the reorganisation of production from the land in units such as these on any considerable scale could only be regarded as a set-back to efficiency in the management of labour, unless the day should come when the economic conditions of national life demand a universal lowering of standards which have been established as the result of a century of industrial progress.

**The Small Employer.**—Next in the social scale to the family farmer is the little capitalist employer, occupying something more than a subsistence holding and working it with family labour, assisted by a small hired staff. This type probably occupies a larger proportion of the farming area of Britain than any other. The farmer works alongside his men and harder than any of them. His farm offers little scope for specialisation in the use of labour, and he and his men must be jacks-of-all-trades. Management, under such conditions, resolves itself into the use of judgment in deciding what are the essential jobs and what is the right time for doing them, together with a certain capacity for leaving undone those less essential, even though over a period of time they will have to be done. The field must be ploughed, and it must be ploughed when the conditions for such work are right; the hedge must be cut, but it need not be cut this week or next, while if it be left until next year, the loss may not be very serious.

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[1] E. Thomas. *The Economics of Smallholdings* (Cambridge University Press), p. 94.

Opportunities for increasing the output of labour under such conditions are few, but something can be done. An internal combustion engine for operating the barn machines is now almost universal, and the sale by their manufacturers of cakes and manures broken and mixed ready for use, has contributed to reduce the disparity of labour efficiency between the smaller and the larger farms. But it must be admitted that there is loss of efficiency when farming for the market is conducted with hired labour employed on units of land too small to admit of much specialisation in occupations, or of the use of much labour-aiding machinery, which can only be countered by hard work. The farmer himself, and any members of his family who may work with him, resemble the family farmer in their long hours of labour. Working as they are for themselves, they work with a drive, and working as they do alongside their men, these in their turn may have a higher standard of output than is expected under other conditions. In short, their position in the competitive market is maintained rather by hard work than by scientific management.

**The Large Employer.**—The next class of employer includes those whose operations are big enough to occupy them in management, leaving them no time to participate in the manual work of the farm. It is not so much a question of acreage as of the type of farming, for under a system of intensive cultivation, say of vegetables for the market, 200 acres of land may call for as much management and labour as 2000 acres extensively farmed.

*Mechanical Power.*—It is this group that offers scope for skill in the management of labour, and the first test of efficiency that comes to the mind is the extent to which machinery is applied, either to speed up labour operations, or to reduce the amount of manual and horse labour needed, or to increase the output of the manual and horse labour employed. But here a warning must be uttered, for increased efficiency in labour management does not follow necessarily upon the substitution of a tractor for some of the horses, or by tapping the grid for electric power. The effective use of power machinery, beyond the ordinary barn equipment, involves a reconsideration of the whole labour organisation of the farm.

In any good agricultural district nothing used to be more striking than the economy of labour in times of more stable conditions on the land. The work of the seasons was arranged to follow through the year, and at any part of the year operations fitted into each other in a way that made possible the maximum use of the labour force at all times. Only at harvest time did it have to be supplemented ; only under stress of weather was it ever redundant. It was the outcome of traditional experience in the working of the farm, and it stood the test until the fall in agricultural prices had reduced to a figure below its cost the value of the output of each unit of labour employed. Such an organisation, well-devised and complete in itself, whose only weakness was that it had come to cost too much, cannot be strengthened merely by the purchase of a tractor and some tractor implements. Such an expedient might do no more than throw out of gear the rest of the organisation. It may be true, for example, that seed harrows can be coupled up behind a tractor to harrow 40 acres a day, but if the farmer's drills cannot seed the land at the same rate, it is obvious that the operations cannot go on simultaneously unless the tractor on the harrows is not allowed to work to full capacity, so that the full saving which it might effect is lost.

The introduction of power, therefore, although theoretically increasing the efficiency of management under certain conditions of farming, will have this result in practice only if it can be fitted in to the general labour economy, either to reduce the manual and horse labour needed to secure the same output, or to produce additional output.

Even where either of these conditions is satisfied, practical considerations may offset an apparent advantage. The introduction of a harvester-thresher may reduce the cost of harvesting a large acreage of corn, but the farmer with a ready market for straw as it comes from the reaper and the thresher, may find no sale for it as it comes from the combine; so that, on balance, he gets no advantage from the cheaper harvesting cost.

There is no doubt, however, that efficiency in the management of labour can be gained on many farms by prudent mechanisation of manual and horse labour processes. There is a tendency to think of it merely as a means for reducing the labour equipment. It is a matter of history that this has been, sometimes, the farmer's only object, and the destruction of the first threshing-machines bears witness to the resentment which this attitude occasioned in the minds of the workers. It is only a few years since an old farm worker told the writer that Providence had sent more wet harvests since the introduction of the reaper-and-binder ! But it cannot be denied that the first effect of the extended use of machinery as an aid to management of labour is to reduce the volume of employment.

Examples may be quoted, however, where the introduction of the new technique has been used by farmers not to displace labour but to intensify production. On a farm in the English Midlands, where 65 acres of potatoes and market-garden crops were grown in conjunction with dairying and corn-growing on a large scale, the complete reorganisation of the labour management following the introduction of power units increased the area intensively cultivated to 240 acres without any serious reduction in the labour staff, although the number of horses maintained was reduced from 50 to 6.[1]

Obviously, this example is not capable of universal application, but it is likely that the ultimate effect of the extension of mechanical power on the farm will be to intensify production and to bring marginal and submarginal land under cultivation, rather than to displace labour.

*Specialisation of Functions.*—But it would be a mistake to think that efficiency in the management of labour on the large or on the intensively farmed holding begins and ends with the substitution of mechanical power for horse and manual labour. Such farms offer scope for carefully organised management by departmentalising the work of the farm. A real economy can be effected by arranging the labour in separate units, each of them employed full time upon its own work without any coming and going between one unit and another. "If you have to take a man from his regular work to help another man for half an hour, you will not see him again for half a day," is the belief of a man who has farmed successfully through these years of depression. His labour force is organised in water-tight units, each one completely equipped to do its work without casual assistance, and itself to render no help to other units. The large dairy herd is divided into a number of smaller herds such that two men equipped with a float and pony can feed, milk (with a machine) and deliver the milk to the lorry driver without any assistance, while being themselves full-time employed. Work on the crops is completely mechanised and is performed by a labour force independent of the dairy. Poultry, an important feature on this farm, is organised, too, in units each sufficient to give full work to a man and a boy in feeding, egg-collecting and moving houses.

This specialisation in the use of labour, it is claimed, effects a real economy.[2] Of course it is common practice on many large farms to find men full-time employed as stockmen, horsemen and so forth, but on this farm specialisation has been carried further by making all departments of the farm entirely water-tight in their labour needs, and even by creating water-tight subdivisions of large departments, such as the cows and the poultry.

On a farm in another part of the country, this specialisation in the use of labour has been applied with the same effect but by a somewhat different method. Here, the farm itself has been subdivided into a number of departments, some of them single-product businesses, as for example, the cows and the poultry, others comprising two products complementary to each other, as for example, corn-growing in conjunction with pigs folded on fodder crops. But the principle is the same and it has proved equally successful.[1]

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[1] C. S. Orwin. *Pioneers in Power Farming* (Agricultural Economics Research Institute, Oxford), p. 18.

[2] C. S. Orwin. *A Pioneer of Progress in Farm Management* (Oxford University Press).

*Farm Layout and Industrial Fatigue.*—There is one aspect of the management of labour which has received too little attention, perhaps, in this country. It comprises that which in other industries has received the name of "scientific management." Most people are familiar with the work that has been done in the investigation of industrial fatigue and the elimination of unnecessary work, particularly under the National Institute of Industrial Psychology. Studies are made of the arrangement of factory buildings and workshops; of the positions of machines and work benches; of the lighting of workrooms; of the movements of workers; of the effect of rest-pauses on the rate of output, and of other factors affecting the efficiency of labour. Striking results have been achieved, sometimes, following quite minor adjustments suggested by these studies. In farming, investigation of this kind has hardly begun, but its potentialities in the management of labour are obvious. It is hardly possible, for example, to watch the men at work in any set of farm buildings without realising the waste of time and effort that their construction and arrangement involves. The homestead itself may be placed at one end of the farm, involving long journeys, or it may be remote from the road. The buildings may be badly grouped, necessitating much walking to and fro, or they may be badly constructed so as to make them difficult of access. The stimulus to pig-feeding under the Pigs Marketing Scheme, for example, must have made many farmers realise, as they never did before, the inefficiency of the old-fashioned pigsties, built so that only a pig could enter them, and involving the maximum of labour in feeding and cleaning.

The remedy here is not always in the farmer's hands. One of the defects of many of our British farm buildings is that they have been built too well. They may be out of date and inefficient for modern farm practice, but they are built too solidly to be scrapped. Moreover, there is no capital awaiting investment to-day in agricultural buildings as there was in the middle of last century. There is scope, however, for small and inexpensive adjustments which may effect real economies in the management of labour. A door in a wall may save a 20-yard walk with a sack of food taken several times a day and every day. A pulley-wheel and hoist may save many a journey up and down a step ladder. It is impossible even to suggest the adjustments that occur when careful observation is made of the men at work. But the study should repay itself in economies, even if only in reduction of fatigue, which will be reflected in the efficiency of the work done.[1]

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[1] A. Bridges. *The Flexibility of Farming* (Oxford University Press).

The managers of the farm mentioned above, on which the acreage under market-garden crops has been so greatly extended of recent years, were led to the introduction of the machines and of the processes which made this development possible by the observation of their men engaged in manual work. Operations such as singling and side-hoeing, planting and interplant cultivation, were laboriously done by hand labour and were a challenge to the managers to find more economical ways of doing the various jobs. And so to-day on this farm, four men with their machines can work as fast as twenty hand hoers, and three men seated on a transplanter can set 150 plants per minute and work long hours without fatigue. The suggestion made here is that observation applied to all farm work, in the field and in the yard, may have results the possibilities of which have not yet been realised.

To sum up, the management of labour is the highest test of the farmer's efficiency. On any holding on which hired workers perform the greater part of the labour operations, labour costs account for about a third of the total farm expenditure, and no single factor contributes so much to success or failure. On the small farm scope for labour management is slight, except perhaps in the ways just mentioned for eliminating unnecessary perambulation and fatigue. On the larger holdings, by the use of power, by specialisation in functions, and, again, by the tests of industrial psychology and scientific management, farmers still have opportunities for helping themselves and helping their men. For the question of the management of labour is not only that of how to make the farm more profitable. Agricultural workers in Britain are the most numerous section of the rural community, and they are dependent, more than in any other country, upon the efficiency of their employers, not only for their standard of life but even for their living. They are entitled to expect that their work shall be turned to the most productive uses.

# MANAGEMENT OF THE LAYING HEN ON THE GENERAL FARM

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Many general farmers maintain that in spite of the low prices obtained for eggs and fowls, poultry are still the best paying department on the farm. Frequently this is the case when the management is efficient and the system practised is based on sound principles. The specialised poultry-keeper and those who have not formerly kept fowls are apt to think that the conditions on the average farm are ideal. They believe that there is ample land available and that therefore the danger of foul ground is obviated; that very little or no fencing is required; that should the hens be spread over the farm, crops will be increased rather than decreased —hence no rent need be charged against the fowls—and that some foodstuffs are available at cheap prices. This popular conception of poultry on the general farm is quite correct up to a point, but few fully appreciate the difficulties that soon become apparent when poultry are introduced in any numbers on the farm.

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[1] W. R. Dunlop. "The Improvement of Farm Labour and its Management by Education," *Jour. Min. Agric.*, vol. xxxvii., p. 782.

It is the purpose of this article to examine these problems and to deal with the management pertaining to the different systems and conditions.

Perhaps the first difficulty confronting the farmer who contemplates keeping hens for the first time is the lack of knowledge. He may have a life-long experience in the management of dairy cows, of sheep and pigs, and also in the cropping of arable land. To master the management of still another form of live stock, when his hands are already full, seems to him to be only asking for trouble. It is well to warn those who feel in this way that unless they are prepared to devote the same care and attention to their hens as to other farm stock, they had better give up the idea entirely. This difficulty may sometimes be overcome by training a member of the family. Such an arrangement has the additional advantage of providing another income without reducing the productive value of the land for other purposes.

**Labour.**—It is strongly recommended that a modest start be made, and that the number of fowls be gradually increased as experience is gained. For this reason, if for no other, it is convenient to use one of the farm hands who can attend to the hens and work on the farm until such time as there are sufficient poultry to occupy his whole time. The most intelligent of the agricultural workers should be chosen, one whose integrity can be relied upon and who comes from a well-living family. This is essential. In this connection it is perhaps well to point out that no man should be expected to work with a commodity without receiving a perquisite in that commodity. The poultryman should certainly have an allowance of one or two dozen eggs per week as part of his wages.

Wages vary from district to district and it would therefore be misleading to suggest any figure, but once the stock of fowls is sufficient to occupy one man's full time, a basic wage, plus a bonus on egg output, may prove the most satisfactory line to adopt.

Where the stock is too heavy for the poultryman, an economy in wages may be effected by employing one or two boys to work under him. Boys who have just left school have yet to prove their worth, but from the author's experience one from a good honest respectable family stands a better chance of becoming a success. On a large poultry farm vacancies in the higher posts will occur from time to time and the most promising lads can then fill these positions.

Too much should not be expected from lads of fourteen. Some apparently hopeless cases may become quite satisfactory after they have worked for a year or two. It should be borne in mind that lads who have just left school have been used to long holidays, and some endeavour should be made to break them in gradually to a seven day per week job. For the first few years it is advisable to relieve them of Sunday work as far as possible and give them a half day per week. Even the poultryman is the better of every second or third Sunday off. With a one-man concern this is impossible, but where several are employed, the men can arrange to relieve each other to some extent at the week-ends.

The perfect adaptation of poultry to the farm forms an interesting study, chiefly because each farm presents its own particular problem. No hard and fast rule can be laid down, but only general principles, which the farmer can apply at his own discretion.

Roughly speaking, there are three different systems that may be adopted: (1) the semi-intensive system; (2) the free range system; (3) the folding system.

1. **Semi-intensive System.**—In this system large houses are used with runs attached. The floors are bedded down with straw, chaff or other suitable material, and three to four square feet of floor space are usually allowed to each bird, the object being to provide adequate shelter and scratching room during inclement weather.

At first sight this method of keeping fowls on the farm may seem rather out of place; but we are not, however, concerned with the system, as usually practised, but with the type of house used. The semi-intensive house has undoubtedly given the best results in most cases. Especially is this so on very exposed farms where no other type would be satisfactory during the winter when egg prices are high. The house in itself is ideal, but the fact that it cannot be moved is a very serious drawback. This leads to the adjacent ground sooner or later becoming foul and the hens begin to suffer from tuberculosis or worm infestation, with serious consequences. One practical way of obviating this danger is to provide two runs for each house. On certain farms where the fields are small this may be accomplished by placing a house against the fence which divides two fields. The birds can then be let out at the front for six months or a year and at the back for a corresponding period. If the unoccupied field can be cropped, so much the better. It is, of course, necessary to run netting along the dividing fence in order to keep the birds from straying into the wrong field. This arrangement has its limitations, because only a limited number of houses can be erected within easy reach of the steading. Where the fields are large, the distance to be covered is considerable and in consequence more labour is required. A further practice, followed more particularly in Lancashire, is to place the houses at various distances apart over permanent pasture with a surrounding fence to keep out cattle. This arrangement works quite well for a time, but is open to risk of foul ground and necessitates houses being left unoccupied for considerable periods in order to rest the ground.

2. **Free Range System.**—This system offers more scope for the perfect adaptation of fowls to the general farm. Houses for this purpose are made on skids or wheels and can be easily removed from field to field.

Two types of house are used under this system :

*Slatted-floor house.*—The average size is 8 ft. by 8 ft. and it is designed to hold eighty birds. Opinions differ considerably concerning the results obtained from slatted houses, but generally it may be assumed that they will not prove satisfactory during winter in exposed districts, particularly in Scotland and in the uplying parts of England. They have the further disadvantage that few if any are cattle-proof. Even sheep may prove troublesome owing to the fact that the grain has to be given outside.

*Solid-floor house on skids.*—This is really a miniature semi-intensive house, which has a solid floor and is bedded down in the same way with chaff, straw, etc. The essential difference is in the size and the number of square feet allowed per bird, together with the distinct advantage that it is easily moved by one or two horses. A convenient size measures 12 ft. by 8 ft. and is designed to hold sixty birds, allowing about 1½ square feet per bird. This at first sight may seem rather too small a floor area for the best results, but it must be remembered that on free range the birds spend a considerable part of the day foraging ; it is only when the weather is bad and at the afternoon feed that all the birds are present in the house at one time. These houses can be made cattle-proof by placing wire netting over the windows and by attaching a few strands of barbed wire to the walls, especially the corners, to prevent rubbing. An important point in this connection is to have the eaves sufficiently high to prevent cattle reaching them.

The free range system provides more scope for adapting the birds to the farm. The essential feature is that the houses can be moved from field to field by one or two horses. No field need be laid down to permanent pasture solely for hens, provided there is another convenient field to place them in.

The houses should be spread equi-distantly over the field, so as to ensure an even distribution of the birds. Not more than fifty birds should be run to the acre in order to ensure an increase and not a decrease in the yield of grass. Generally speaking, however, the farmer has more land at his disposal than he needs and this question does not therefore arise.

Where a reasonably sized flock of birds is kept, some additional equipment apart from the houses is desirable, if not a necessity. On large farms the fowls may be kept at some considerable distance from the steading and the method of transport must therefore be as expeditious as possible; many hours may be lost each week in travelling to and from the fowls alone. The ordinary cart and horse is too slow. What is required is a smart pony and a float or lorry with roller-bearing wheels and rubber tyres. This type of conveyance will pay itself many times over. Much time is saved when the pony can come home at a trot on the return journey. An excellent lorry can be made from the chassis of an old car.

Some prefer to run water out on the lorry each morning and the grain at night, and others again store several days' supply beside the houses. Individual circumstances will determine what is best. The writer adopts in most cases the latter method. Empty 40-gallon barrels are used for this purpose, which are placed at convenient points in the field. They are fitted with circular wooden lids, and those containing grain have their lids hinged and padlocked. This precaution may seem unnecessary, but is the result of experience. Should any horse gain access to grain the results may be fatal, and even with cows a heavy drop in the milk yield may take place.

The flock in each field should be kept reasonably small, since it is somewhat troublesome to the poultryman to find some five hundred to a thousand birds gathered to meet him at feeding-time. If convenient, feeding should commence from different ends of the field each night. This will to some extent prevent birds overcrowding in certain houses at roosting time. The grain may be scattered on the grass when no other live stock are in the field. This is of great benefit to foggy pasture, but for the best results in winter, feeding in troughs is preferable in order that the poultryman may see at a glance whether the birds have had sufficient food.

In the general routine work recurrent jobs should be allotted to certain days of the week. For instance, if the mash hoppers are of a sufficient size to require filling at reasonable intervals, certain days may be fixed for doing so. A certain day may also be allotted to cleaning the dropping trays and shifting the houses. The latter point needs further elucidation. To fix a definite time for shifting houses is unwise, as so much depends on the soil and climate, but it is well to point out that owing to the comparative smallness of the free range house in relation to the birds accommodated, the ground in the immediate vicinity may quickly become puddled. This has the serious result of causing dirty eggs and also reducing the yield of grass. Each house need only be towed little more than its own length at each shift, and in view of the comparative speed at which this can be done, it should not occupy too much time, even if carried out weekly.

The question is frequently asked how often the litter should be renewed on the floors, and again the answer must be that no definite period can be stated. In a dry summer the litter may last for several months and in very wet weather it may require changing once a fortnight.

Portable houses will occupy grass fields for the greater part of the year, but at certain seasons a distinct economy can be effected by removal to other parts of the farm. The most important move is on to the stubbles after harvest. Here a distinct economy is made in the grain bill for some weeks, but a word of warning is necessary. Some think that because there is plenty of grain about, no other food is required. This is a great mistake and means that eventually the birds are starved, with a consequent reduction in egg yield which will more than cancel any saving in the food bill. The dry-mash hoppers should always remain filled and the birds should be tried with a small feed of grain in the afternoon. If they do not eat it all, the ration can be cut down a little, but it is well to remember that the grain on the stubbles is becoming less and less every day and the afternoon feed must be increased as this takes place.

How long the hen-houses can remain on the stubbles depends largely on the ploughing. If possible they should be kept in the field while this is in progress. They can be so placed as to come between the ploughings. The hens will not only do an enormous amount of good by clearing the land of harmful grubs, but they will also provide themselves with a new source of food.

Much grain is shed in the stackyard at " leading-in " time and during threshing, and it is well worth while placing at least one house beside the stacks. .Some farmers dislike this because their stackyard is adjacent to the steading, and they object, and with good reason, to having birds about the farm buildings. In many cases, however, stacks are placed in the fields and these can be usefully utilised for this purpose. On exposed farms the stacks provide excellent shelter and for this purpose alone it is well worth while to make use of them.

Mention has already been made of the tendency to overcrowd under this system and the difficulty at feeding-time where a large flock is kept. A further disadvantage, and one which is felt more on an arable farm, is the tendency of the birds to stray into any adjoining field which contains a growing crop. In hunting areas free range methods on a large scale may well be hopeless. To overcome these last two drawbacks resort may be had to the Folding System.

3. **Folding System.**—Under this system birds are placed in small houses with a run attached. The usual size measures 20 feet by 5 feet, and is designed to accommodate twenty-five birds. Each day the house is moved on to a fresh piece of ground. The fold houses can be made fox-proof and they can be moved alongside a growing crop: in addition most models are cattle-proof.

The following further points may be mentioned :—

(1) This system lends itself to a better organisation; thus several units can be created without much additional supervision.

(2) The birds are in flocks of only 25, and it is easy to pick out any ailing ones.
(3) There is no cleaning out of houses.
(4) There is no extra expense with wire netting.

The folding of hens is comparatively recent and there is still much to be found out about it under varying conditions. A fairly light soil and a reasonably dry climate seem to suit best, and under these circumstances fold houses have done very well. Grass land with a good sole is almost essential, otherwise the run quickly becomes bared.

Moving folds on to the stubble after harvest is so much time wasted, since the birds will eat all the grain there is in the run in a very short time and the ground will become bared before nightfall. A good plan to overcome this is to cut two hen exits, one on each side of the run. The houses can then be spread over the stubble, as practised in the free range system, and the birds allowed to roam at will. By this simple expedient folds are quickly converted into free range houses.

The different types on the market are innumerable and it is hardly possible to describe them here, but the two methods of moving the houses have an important bearing on the management required.

These two methods are to side-step the house its own breadth and to pull or push it its own length.

Side-stepping may be done by simply attaching a handle at each end of the house and first lifting one end sideways and then the other ; with heavier houses the same purpose may be achieved by means of a lever or wheel.

The folds are placed end on in one long line across the field, the length of a house apart. They are then side-stepped until they reach the opposite fence, when they can be brought back along the uncovered track. A simple calculation will show that with 50 folds to house 1250 birds, one row of these houses would reach over 666 yards. This is one of the greatest drawbacks to this lengthwise formation. It is of little use to place supplies of water and grain beside a row such as this, and in practice a pony and lorry are usually employed at feeding- and watering-times.

In the second method the houses are placed side by side and approximately their own width apart. A row of 50 houses in this formation will measure about 170 yards. Such a length is quite suitable for grain and water storage in the field. The houses are moved their own length each day until they reach the end of the field, when they can be brought back along the intervening tracks. A modification and improvement of the above method is to have two rows, one in front with houses their own width apart, and the other a few yards behind on the untrodden tracks of the first row.

This description of the three systems deals only with the salient points of management. But the farmer may be excused if he still feels puzzled as to which method to adopt. As previously stated, the writer has purposely avoided making any definite recommendation, because of the great variation in soil and climate. Even in the same district one system may succeed on the sheltered side of a wood, whereas on the other side failure may be certain. A good plan is to observe the practice in your district and to consult a neighbouring farmer who has been successful with his hens.

**General Management.**—So far the methods relating to particular systems have been discussed, but there are certain practices common to all systems which have not yet been dealt with.

*Feeding.*—There are several ways of feeding fowls successfully, but for commercial egg production, the dry-mash method is to be recommended as the simplest and the most labour-saving. Dry mash is fed in hoppers *ad lib.* and under farming conditions these hoppers should be kept inside the houses. As much grain as the birds can eat is given in the afternoon, preferably in troughs. No other food is necessary except during the winter months from the end of September to March, when it will pay to give a small feed of wet mash at mid-day.

The usual practice is to feed a fairly large proportion of maize during the winter, but the contents of the grain mixture may be varied according to the price of the different cereals. Wheat and maize are the staple ingredients, but oats or barley may to some extent be included.

*Culling.*—The feeding bill usually amounts to between 50 and 60 per cent of the total costs on a poultry farm, and it is therefore highly essential that unprofitable birds be ruthlessly culled. Far too many birds that will never show a profit are carried on some farms. The farmer should endeavour to master this art of culling, because it will play an important part in the economy of the farm. The subject is dealt with in most textbooks, but a demonstration from an experienced friend will prove of very great assistance.

Culling is in few cases carried out often enough. An effort should be made to handle the birds once a month. It is surprising how many birds can be removed each time without lowering the egg yield. The birds may be handled at night on the perches by lamplight or during the day. The former method does not disturb the hens so much, but the latter procedure is more often convenient. If culling takes place during the day a wire frame stretched across the house will prove a convenience. The birds are driven to one end of the house and kept there by the frame. As each bird is handled it can be dropped over the frame and let outside, or in the case of a culled bird, placed in a hamper. Some use a catching crate, which is designed to hold six to twelve birds and to fit over the hen exit. The hens are then driven into the crate until it is full, then they are handled and the crate is refilled.

Culling should be continuous, but the most important times are: (1) When the pullets are first put into the laying houses. All late-hatched and backward pullets can be removed at this time. If the only fault is that they are late hatched, it may pay to put them in a special house for the purpose and light them up during the winter. This is a case where lighting does pay; otherwise the "culls" should be sold for the table. (2) During the latter half of winter, when the late maturers can be removed. (3) In July and August. Early moulters are usually the poorest producers and those moulting in the early summer may be treated as such. The question of moulting depends to some extent on the time of hatching and due allowance should be made for this.

Apart from the saving in the food bill, as already stated, frequent culling often saves the carcase value of a bird. There is always a number of hens suffering from a physical injury such as a lame leg, sore mouth, etc. If such birds are detected in time they are excellent for the table, but if overlooked they will lose condition rapidly and become an entire loss.

*Marketing.*—One more aspect of general interest remains to be discussed—that of marketing. If it is realised that even an average increase of only twopence per dozen on a thousand-bird farm may amount to £80 per annum, the importance of a good market need not be stressed further. Much depends on the situation of the farm. If close to a town, a direct connection may be made with shops or possibly schools. If the farmer already retails his milk, an excellent opportunity is available for retailing his eggs. The one helps to sell the other. Orders may also be taken for boiling fowls and roasting chickens.

The spring surplus sometimes presents a problem, but direct contact can be made with consumers, even at a distance, for the sale of preserving eggs. The simplest means of establishing a connection is a circular-letter stating the price and the high quality of the eggs produced.

**Conclusion.**—In the course of this article, much has been written of the technical problems connected with the keeping of fowls on the farm. Important as these are, they are not perhaps so essential as the type of man behind the undertaking. This is shown repeatedly in the costings kept by our various colleges of farms almost identical in situation and equipment. Some of these have shown a loss of over five shillings per head, and others again a profit of well over that figure.

The once popular conception that fowls were only to be kept to supply the wife with "pin money" or to provide work for the son who has failed at everything else, is now fortunately disappearing. Only the man with brains and energy and the necessary knowledge should attempt to go in for poultry farming on a large scale. With such qualifications, there is every reason to anticipate success.

# THE MANAGEMENT OF TEMPORARY PASTURE

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The object the farmer has in view when he lays down a temporary pasture for three or four years is to get a good mixture of grasses and clovers for as long a period in the year as possible that will be capable of giving a good live-weight increase or a good yield of milk, as the case may be.

To put it shortly, the success of such a temporary pasture depends on:

1. The previous treatment of the soil and crops;
2. The seeds sown and the management of the grain crop;
3. The treatment and management of the pasture itself.

The importance of these factors, so far as the results to be obtained are concerned, is possibly in that order. They may be termed (1) the foundation, (2) the establishment, and (3) the utilisation.

As with other crops, the best results with temporary pasture are obtained when the soil is well drained, clean, and in good heart, a condition which can only be obtained by continuous good farming. This is the case no matter what seeds are sown or what treatment is followed thereafter. When a soil is in good condition there is much less tendency for grasses to go into ear, but they form blades more readily; a soil in good heart is also better able to withstand drought, which often has a disastrous effect on pasture. On the other hand, on a poor soil low in organic matter the grasses go much more readily into ear.

Although artificial manures often have a good effect when applied direct to temporary pasture, the best results are undoubtedly obtained when they are applied along with a good dressing of dung to the previous root crop and to the grain crop, so that they may be thoroughly incorporated in the whole body of the soil. No hard and fast rules can be laid down as to what should be applied, but the following have given good results on the Craibstone soil.

*Root Crop*—
1 cwt. sulphate of ammonia.
3 ,, superphosphate.
2 ,, ground mineral phosphates or steamed bone flour.
1 ,, muriate of potash.

*Grain Crop*—
½–¾ cwt. sulphate of ammonia.
2 ,, superphosphate.
3 ,, ground mineral phosphates or steamed bone flour.
1 ,, muriate of potash.

The dung has given better results to the pasture when applied in the drill for the root crop rather than when spread on the surface beforehand and ploughed in, while on light soil it gave even a better result when spread after the root crop was removed and ploughed in before the grain crop. That is, it gave the best results when applied as near the grass crop as possible. Not only has the dung a beneficial effect from the manurial ingredients it supplies, but it also helps to conserve soil moisture and encourage soil bacteria.

There is often much doubt regarding the use of lime. There is no doubt, however, that on many soils a good dressing (20 cwt. or more per acre) must be applied to obtain the best results, and thereafter 7 to 10 cwt. in each rotation. It is best applied to the lea six or eight weeks before ploughing.

On the other hand, many soils appear not to be benefited at all by an application of lime. For example, Professor Hendrick has pointed out that soils in the Aberdeen district, although showing a deficiency of lime, are plentifully supplied with other bases that fill its place. A good rule to follow is that if red clover grows well there is little need to use lime.

While the kind of root crop will have some effect on the take of grass and clover, the grain crop will usually have a greater and, in some cases, an adverse effect. There is usually a better stand of both grasses and clovers after potatoes than after turnips, owing to the grain crop being poorer and thinner after the former crop.

On light soils the supply of moisture at the time of sowing and for some time after will have a considerable effect on the success of the stand. On heavier soils there is usually not the same difficulty. In fact, in some cases where there is an abundance of moisture the new grass may take the upper hand and so tend to smother the grain crop. For this reason many farmers who have this class of soil delay sowing the grass seeds until the grain crop is well up. They harrow, sow the seeds, again harrow and roll. The harrowing has usually a beneficial effect on the grain crop, especially if the soil has been battered by heavy rain, and also helps to destroy any annual weeds that may have come up.

On light soils the turnips should be pulled and the soil ploughed early. This will help to consolidate the soil and so tend to keep it moist. The seeds should be sown as uniformly as possible on the harrowed surface (which, if loose or cloddy, should be rolled beforehand) as soon as possible after the grain, and harrowed and rolled at once. It would be a fortunate circumstance if there were rain soon after.

Barley or an early strong-strawed type of oat is the best cover crop. The straw types of oats, like Potato, owing to their high tillering power, usually have a distinctly adverse effect on the young grass and clover plants, especially if they have been thickly sown and have become lodged. Advantage is gained if the grain crop is cut as early as possible. Care should be taken to see that the stooks do not stand too long on the same places, as much damage often results.

So far as the seed mixture is concerned, experiments carried out all over the country during the past 25 to 30 years have shown that there is no need to use a large number of grasses. Those most commonly in use are perennial ryegrass, cocksfoot, timothy and Italian ryegrass, with crested dogstail on more extreme soils and rough-stalked meadow grass on moist soils and in districts of heavy rainfall, while meadow fescue has been found to do well in the Glasgow area and tall fescue in the Edinburgh area.

During the past ten to fifteen years more attention has been paid to the leafy, late-flowering types of grasses. Mixtures like the following have been found to be suitable on ordinary average soils for three or four years' pasture (using seed of good quality):

| | | |
|---|---|---|
| 13 | lb. | perennial ryegrass (9 or 10 lb. Ayrshire and 3 or 4 lb. Kent evergreen). |
| 5 | ,, | Italian ryegrass (Irish or Danish). |
| 8 | ,, | cocksfoot (4 or 5 lb. Danish and 3 or 4 lb. New Zealand). |
| 4 | ,, | timothy (Scots). |
| 2 | ,, | broad-leaved red clover (English or New Zealand). |
| 1½ | ,, | late-flowering red clover (English, Montgomery and Swedish). |
| 1 | ,, | alsike clover. |
| ½ | ,, | wild white clover (English). |

If hay is taken the first year and the grass is not eaten beforehand, the Italian ryegrass should be omitted.

In discussing the utilisation of pastures one must keep in mind that it is grown for the stock, and what may be best for the stock may not necessarily be best for the pasture. A small amount of grass at a particular time may be much more valuable and more profitable than a much larger amount later on. This observation is the answer to one question, among others, that is often asked: "Should new grass be grazed during winter or early spring?" No doubt when it is grazed the following hay crop will be much smaller or the pasture in early summer will be later. When new grass is grazed, the precaution must be taken, however, not to poach the soil by putting stock on after heavy rain, especially on heavy soil, otherwise the subsequent pasture will be very adversely affected.

It is essential that hay cut in the first year should be cut early. Not only is the quality of the hay better, but early cutting enables the white clover to become established more quickly. Similarly, the aftermath must not be allowed to grow too much before it is grazed or cut. Many fields are temporarily spoiled by the aftermath being too far advanced before it is used.

In the spring of the first year a temporary pasture will consist largely of red clover and ryegrass. In the next year, when most of the red clover has died out, its place will be taken first by cocksfoot and timothy and later by a mixture of white clover and these grasses.

Red clover acts in two distinct and opposite ways on grasses. When the conditions are particularly suited to it, it may be too plentiful and have an adverse effect on the grasses and also on white clover. In this case, when the field is eaten in the first year and not hayed, it is advisable to keep it well grazed in order to remove the competition as far as possible. On the other hand, red clover helps grasses by the nitrogen it is able to extract from the air, and since the plant is deep-rooted this is well distributed through the soil. Where red clover is deficient, the grasses lack vigour all the time the field is in grass, and even although white clover comes in later the pasture is rarely good.

The amount of pasture produced will depend mainly on three things : the amount of moisture, the temperature, and the amount of nitrogen. During winter and early spring there is sufficient moisture and possibly plenty of nitrogen, but the temperature is usually too low, and it is only when it rises that growth commences. Should a dressing of nitrogenous manure be applied in January, February or March, it will show no result until the temperature is high enough to start growth. Usually in May, and especially in June, all the factors are at their maximum for growth, which is then very rapid. Later on, should a dry spell occur, as it often does, the deficiency of moisture is the limiting factor, the temperature being high enough and the nitrogen sufficient.

An examination of the records of grazing trials shows that both cattle and sheep usually put on the largest live-weight increase between the end of May and the beginning of July. This may, however, be due not altogether to the feeding quality of the pasture but partly to the condition of the stock. Anyone who has weighed cattle periodically will have observed that they do not put on a steady increase, but advance by fits and starts, periods of good and poor progress usually alternating. Cattle kept as " stores " during winter and fed only on turnips and straw may put on only from ½ to 1 cwt. during the winter months. When, however, they are put out to pasture, they may put on anything from 1 to 2 cwt. during May and June, after which time the increase will be less. If the cattle, in addition to turnips and straw, get extra feed during winter they will give a much greater live-weight increase during that period, but will add much less weight after they are put out to grass.

The chief difficulty with the stocking of pasture fields on a farm is that a certain number of stock has to be kept, whatever the rate of growth of the grass. In June it usually grows much faster than it can be eaten, whereas later on, when there is insufficient moisture, growth is much slower than consumption. It is always well to have a reserve portion that can either be grazed if required or made into hay.

During growthy weather, when all the essentials are favourable, the grasses and clovers will grow quickly and it will be safe to eat the pasture bare. Later on, when growth is reduced through deficiency of any of the essential factors, it is not safe to graze closely, as at this time a closely-grazed plant will produce much less and will also take much longer to recover. It is also essential during dry weather to keep a good covering of grass to prevent evaporation. When there are many bare spots in pasture the soil dries more quickly. The pasture, therefore, should never be eaten bare; otherwise if the dry period is prolonged there will be little grazing during the rest of the season. The ideal to aim at is not to graze the pasture any faster than it grows. Although the quality of close-grazed pasture is better, the total amount of food materials it produces per acre is considerably less than that of the pasture allowed to have reasonable growth.

The best use can be made of pasture when there is mixed grazing, as one class of animal will eat what another will leave. Cattle and sheep may graze either together or alternately.

In the spring of the second season, pasture should be eaten sufficiently bare to allow the white clover to become established, but it should not be eaten too bare afterwards, since the white clover would then tend to take the upper hand and the grasses would suffer. Sheep in particular should not be kept on pasture for too long a spell, as they eat into the heart of the grasses, especially cocksfoot and timothy, and so retard their subsequent recovery.

A good balance must be maintained between grasses and clovers if the best results are to be obtained. This is made easier now by using different types of grasses which grow at different seasons. Thus, Danish cocksfoot comes early in spring and when succulent is well eaten down. Naturally, it tends to go into ear, but well-arranged grazing may prevent this. New Zealand and similar late-flowering cocksfoots come into prominence later, stock out better and keep fresh and green into autumn, while if the weather is favourable and no frost occurs they will remain green well into the next year. At this time the Danish is very grey and withered-looking. Similarly, Ayrshire and other early-flowering perennial ryegrass come earlier than the Kent evergreen or other late-flowering ryegrasses, which in turn are better during summer, autumn and early winter. Since wild white clover came into more extensive use, the former has improved considerably, especially in three or four years' pasture, owing to the nitrogen provided by the clover.

When a field of temporary pasture is well dunged and manured previous to laying down and is therefore in good heart, and especially when there is abundance of red clover, there may be little need to use any more artificial manure. There are, of course, many cases where manuring directly to the grass will be beneficial and even necessary, but no hard and fast rule can be laid down, as the conditions in different fields vary so much. When a hay crop is taken in the first year, possibly a complete dressing such as 1 cwt. sulphate of ammonia, 2 cwt. superphosphate, and 1 cwt. potash salt, applied during March or early in April, may give a good increase. If it is considered that phosphates are necessary for the benefit of wild white clover, 6 or 8 cwt. basic slag (high citric solubility) will in most cases in eastern districts give a satisfactory improvement; where there is a higher rainfall, ground mineral phosphates may be successfully used. The addition of potash in many cases is also necessary. There are other cases where it shows no apparent benefit, but the supply should be kept up; otherwise it will ultimately show a deficiency.

Assuming that there is sufficient phosphate, potash and lime present, a dressing of 1 to 1½ cwt. nitro-chalk or nitrate of soda or ¾ cwt. sulphate of ammonia applied in the spring of the second year will encourage not only the grasses but also the white clover, which will become established much more quickly, and there will be a good thick mixture of grasses and clovers during summer. Once the wild white clover is thoroughly established it will be able to supply the grasses with most of the nitrogen they require.

During the past few years the Hohenheim method of grazing has been tried in many parts of the world. The essentials of this method are: (1) dressings of phosphate, potash and lime, if considered necessary, (2) three to five dressings of a nitrogenous manure per season, and (3) grazing of comparatively small fields with a large number of stock for a short period and then resting, a dressing of nitrogen being applied after each grazing.

As a result of these trials carried out in different parts of the world, however, there is not general agreement as to the value of the method. The divergence of the results is in all probability due to the different conditions prevailing during the time of grazing. No doubt the success, so far as the manurial dressings are concerned, was in many cases due to the fact that the fields had been in grass for a time and were in very poor condition; hence the manures were bound to have a beneficial effect. On the other hand, on temporary pasture where the fields were in good heart there was not the same scope for improvement in this respect.

In considering the application of this method to temporary pastures it is well to consider its two component elements separately. So far as manuring is concerned, there are two extreme cases: (1) where there is little white clover, and (2) where there is abundant white clover at the commencement. Trials under both of these conditions have been carried out at Craibstone for three years. In the first case, where nitrogen was applied the grass was earlier in spring and there was a distinct increase in the first year, a smaller increase in the second year, and a slight decrease in the third year, as compared with the plots where no nitrogen was applied. The effect of the nitrogen on the composition of the pasture was that the white clover was prevented from coming in, but that there was a large increase of annual meadow grass in the third year. Where no nitrogen was applied, on the other hand, the wild white clover came in normally and there was a good mixture of grasses and clovers in the third year.

The second trial was begun on third year's grass where there was a good mixture of grasses and a thick sole of wild white clover. In this case the pasture was no earlier in spring where nitrogen was applied, and the grazing capacity, both with and without nitrogen, has been practically the same for the three years during which the trial has been carried out; this indicates that the wild white clover was evidently supplying all the nitrogen necessary for the grasses. It is only now, however, after three years, that the nitrogen is showing a slight adverse effect on the white clover.

In both trials, slag and potash were applied in the winter before the first dressing of nitrogen was given.

The result would no doubt be more satisfactory where there was only a fair amount of wild white clover with a good mixture of grasses. In any case, the lesson to be learned from these trials is that on the Craibstone soil it is dangerous to apply too much nitrogen before wild white clover is established, and that there is little need to apply it when there is abundance of wild white clover. Each field must be studied separately and the most appropriate treatment given to keep it in good growing condition.

One of the advantages claimed for the second element in the method under discussion—the rotational method of grazing in small enclosures—is that the grasses do not go into ear so readily and even if they do they are eaten before they become fibrous, with the result that the feeding quality is improved and more milk or a greater live-weight increase is obtained. It is taken for granted that where stock are kept continually in the same field the grasses go readily into ear and are refused by the stock, with the result that poorer yields are obtained.

The Craibstone trials, so far as feeding cattle are concerned, do not altogether bear this out. Where the cattle were kept without frequent shifting so long as there was sufficient grass for them to eat, the grass was neither allowed to go badly into ear nor was it eaten too bare, but was nearly all well and evenly eaten. There was a good mixture of grasses and clovers and quite as high live-weight increases were obtained, indicating that the quality was quite as good as when the cattle were shifted. Possibly the advantage of the rotational method has been shown in cases where by the ordinary method the pasture was badly grazed and the grasses were allowed to go into ear.

When the grasses grow faster than the stock can eat them and where there is rank growth round the cattle's droppings, cutting with a mower should be practised. This should be done in good time before the formation of seed has begun; otherwise the plants will be weakened and will take some time before they begin to grow again. There is also a danger of their smothering the wild white clover. When cut early, however, the grass plants recover much more quickly and the wild white clover gets a chance. It is also worth while to spread the droppings of cattle periodically.

Very often there are different kinds of soil in a field, and the stock prefer the grass growing on certain parts, usually where the soil is sharp. It frequently happens that there is an area at the foot of a field where the soil is soft and the grass is neglected, with the result that it goes badly into ear and the white clover never gets a chance to become established. In such a case, the only satisfactory method is to fence off the part and graze it separately and thoroughly ; this should be done in good time before the grasses become too rough.

When grass is wanted at a particular time of the year for any purpose, the pasture must be rested long enough beforehand to enable it to grow sufficiently for the purpose in view. A pasture cannot be expected to provide grass all the year round. Thus, if early grass is wanted in spring, no late autumn or winter grazing should be permitted, so that the grass may get a good start. Unless there is a very large percentage of wild white clover, an application of a nitrogenous manure about March will make the grazing earlier by ten to fourteen days. (If sufficient phosphate and potash were applied to the previous crops, no further application should be required at this time.) Again, if grass is wanted during the winter months then the pasture must be rested for a sufficient time in autumn to allow the grasses to become well advanced before growth becomes slow. Only the driest fields should be used for winter grazing.

In all probability the next stage in the utilisation of part of the grass will be to cut it frequently during the season and dry it. For this purpose a comparatively cheap drying apparatus which may form part of the general equipment of the farm, like a threshing-mill, is required; alternatively, rather larger portable apparatus may be operated by contractors who can carry out the process at individual farms as necessity occurs.

The most suitable seed mixtures for this purpose will have to be evolved and also the most suitable manures to use. In the meantime, it would appear that, in order to get the best return during the season, a separate shift should be set aside each year and that a good dressing of a nitrogenous manure should be applied after each cutting.

# THE MANAGEMENT OF HILL PASTURES

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AN extensive area of the land surface of Great Britain is occupied by hill pastures. The most recent (1934) returns of the Ministry of Agriculture and the Department of Agriculture for Scotland show that rough grazings account for 5,424,000 acres or 14·6 per cent of the total in England and Wales, the corresponding figures for Scotland being 10,409,549 acres or 54·6 per cent of the total. Of this uncultivated land a considerable proportion, particularly in the north and west of the country, consists of hill grazings, and it is apparent that, although the value per acre of this land may be low, yet on account of its extensiveness it constitutes in the aggregate a valuable national asset, and plays an important part in the agricultural economy of the country.

As this land is enclosed only in large units, it is impossible to exercise the same degree of control over the grazing and general management as is possible in the smaller fenced fields of lower elevations. For the same reason comparatively little controlled experimental work has been carried out on the open pastures of the hills and conclusions as to their management have to be based for the most part upon the methods of survey and comparison, together with the accumulated experience of practical men. The issue, moreover, is complicated by another factor, viz., that grazing is not the sole source of income from considerable areas of hill land. The sporting value of these lands has to be taken into account and the interests of grouse have to be considered along with those of sheep.

**The Vegetation and Grazing Value of Hill Pastures.**—Even to a casual observer with no special botanical knowledge, it is obvious that the vegetation of a typical hill pasture is not of a uniform or homogeneous character, but consists rather of a patchwork of plant communities, varying from place to place in accordance with soil, topographic and other factors. In view of the known fact that hill pastures vary in their value for grazing sheep, the question naturally arises whether there is any correlation between the grazing value of a farm or hirsel and the natural vegetation which the ground supports. For the reasons mentioned above it is not easy to obtain exact information on the grazing value of the different types of herbage, but it is certain that there is a connection between vegetation and grazing value, although there are no doubt also other factors which operate in determining the value of a hill grazing, such as situation and exposure, water supply and the general healthiness of the ground for sheep. In the course of a survey of a typical hill area in the south-east of Scotland carried out some years ago, under the auspices of the Edinburgh and East of Scotland

College of Agriculture, it was clearly brought out that there is a correlation between the character of the vegetation of a hill pasture and the value of the land for grazing, as estimated by the farmer or shepherd, and confirmed where possible by the record of stock carried and prices obtained for the sheep. This survey showed that the best grazings are associated with a good representation of certain types of pasture, while other types are more characteristic of inferior grazing ground, and further that a mixture of different kinds of vegetation gives better grazing than the predominance of one or two. Specifically it was shown that the best grazings are generally associated with abundance of good grassy pasture, *i.e.* the alluvial ground of the stream sides and the spring-flushed grassy patches of the hill slopes, together with a good extent of heather, more especially of the better type which recovers quickly after burning, and with areas of peat carrying a mixed herbage of heather, draw moss (*Eriophorum vaginatum*), deer grass (*Scirpus cæspitosus*) and other food plants. Of less value were the grasslands dominated by white grass (*Nardus stricta*) or blow grass (*Molinia cœrulea*) and the dry heathy grasslands on thin soil. It is thus clear that different kinds of herbage differ in their capacity to support a sheep stock, and further, that the value of the different types varies with the season, some being more or less useful all the year round, while others have their chief value at certain specific seasons. The value of a mixture of vegetation types most probably lies in the ability to provide grazing at all seasons of the year. Moreover, the value of any particular species of plant or kind of herbage is determined also to a large extent by its condition, and much can be done by suitable management to improve the value of the grazing.

It would appear, therefore, that the management of hill pastures should aim at utilising the various types of vegetation as fully as possible at the various seasons when they are of most value, at the maintenance of the herbage in the best condition for providing food for the animals, and, where possible, at extending the area of the more valuable types of vegetation at the expense of the less useful. In the last connection it may be noted that the advisability of attempting to increase one kind of vegetation at the expense of another will depend to a great extent on local circumstances. Thus where heather is a widespread and extensive type of vegetation, and especially if there is much heather of the less useful slow-growing type characteristic of hard ground, it may be sound practice to endeavour to replace it by grass, as can be done, where conditions are favourable, by running hard spring water over the surface of the ground. On the other hand, where good grass is abundant but little heather is available, it would more probably be wise to endeavour to conserve and encourage its growth.

Of the different types of hill vegetation, some provide grazing at all seasons, while others have a more limited period of usefulness according to the season at which the dominant and associated plants are in good grazing condition. Thus the well-grazed grassy areas of the stream sides and flushed hill slopes are of value throughout the year and are pretty constantly grazed by the sheep. Their period of greatest luxuriance is in summer and autumn, but they continue to provide a measure of keep during winter and are of value during periods of storm. Heatherlands, if properly managed, can also provide food for sheep throughout the year, but some are more valuable than others. The value of heather depends on the abundance of young green shoots which it bears, as it is these that are eaten by sheep. This in turn depends upon a number of things, among which the nature of the soil and the age of the heather are important. Old heather produces comparatively little of this fresh young growth and is of correspondingly little value for sheep. Again, on " hard " ground, *i.e.* soils deficient in humus, heather tends to become hard and woody at an early age, and this " scroggy " type is less valuable than heather grown on soil with a surface layer of peat or moist humus.

Peat, when wet, usually carries a vegetation dominated by the cotton grass or draw-moss. When the peat is drier, heather becomes more prominent and a mixed vegetation of heather and draw-moss is found, associated with deergrass, stool bent (*Juncus squarrosus*) and other plants of more or less grazing value. The heather growing on land of this character is generally of a good type, capable of providing food for sheep at most seasons of the year. The draw-moss is a plant of great value in the early part of the season, February and March, when other food may often be scarce. The young shoots of this plant, which begin to grow early in the year, are provided with a long white succulent base which is attractive to sheep and is pulled and eaten at this period. The value of the peat vegetation depends to a large extent on its accessibility. If high lying it may be inaccessible to the sheep at the time of year when the draw-moss is at its most useful stage.

The rough grasslands dominated by white grass and blow grass are of value principally in the spring months. Both of these grasses begin to grow fairly early in the season and the young fresh growth is taken by sheep at this stage. As the season advances, however, the plants become coarse and fibrous and are rejected by sheep. Finer grasses such as *Agrostis*, *Festuca*, etc., which are associated with these types of herbage, furnish a certain amount of grazing throughout most of the year, provided they are not allowed to become too coarse and unpalatable. Burning in spring helps to reduce the rough herbage and lengthens the season of usefulness of these types of vegetation.

**Moor Burning.**—One of the most common methods of maintaining hill ground in good grazing condition is by burning. The fire destroys the old woody or fibrous growth which is of no value as food and a younger fresher growth is encouraged to develop. In burning, the object is to secure the development of this new growth as soon as possible, so as to reduce to a minimum the time during which the land is unproductive. In the case of the rough white grass or blow grass grazings this is not difficult, as the grasses which are the chief contributors to this herbage have their renewal buds well protected and the fire removes the old growth without seriously damaging the plants, which soon recover and provide grazing in the same season. On the other hand, the effect of burning on this type of herbage lasts for a season only and in the year following the fire the herbage gradually reverts to its rough condition. Frequent burning of *Nardus* and *Molinia* is therefore necessary to keep the grass in good condition for grazing. Where these plants are dominant burning every two or three years is required.

In the case of heatherlands, recovery is not so rapid and may be exceedingly slow. Two factors are of chief importance in determining the rate at which regeneration of the vegetation will take place, viz., the character of the ground and the age of the heather when burned. The quickest return is got on soils when there is a moderately thick surface layer of peaty or humus material. On such soils recovery may be expected to take place quickly, with the ground well covered by about the second year and good grazing for sheep by the third or fourth year. On the steeper slopes, where the surface humus is thin, recovery is a slower process and the ground may remain imperfectly covered for several years after burning. If the heather is allowed to become old and grey before burning, regeneration is slower than where it is burned young. Regeneration of burned heather takes place either by the growth of seedlings or by the development of " root shoots " from the charred stumps at or just below soil level. A quicker return and more rapid growth may be expected where there is a substantial amount of recovery by the latter method, as heather seedlings grow slowly in the early stages. If heather is allowed to become too old before burning, little growth of root shoots takes place and in certain situations, especially on " hard ground," regeneration by seedling growth is a slow and uncertain process. There is a danger in such situations of the invasion of the ground by other species less useful than heather, such as blaeberry, bracken or *Nardus*, with consequent permanent deterioration of the pasture.

On account of the variation in conditions it is not possible to lay down any definite age at which heather should be burned, but burning should take place while the plants are still vigorous and before they become excessively woody and bushy with reduced production of green shoots and reduced flowering. On good heatherland where a rapid return can be expected, burning every ten to fifteen years has given good results. On hard ground where rapid seedling growth cannot be relied upon, it is advantageous to encourage the development of root shoots as much as possible, and experience shows that this can best be accomplished by a light burning before the heather gets too old. Frequent burning of such areas of heather is therefore advisable, but may be difficult owing to the scanty cover developed for some years after burning. The aim should be to burn lightly as soon as the fire will carry and thus to encourage the renewal of the cover by vigorous shoot development.

**Bracken.**—The control of bracken is one of the most serious problems confronting the hill farmer. The detrimental effects of this weed on hill pastures are too well known to require detailed recapitulation and there is abundant evidence that the plant is spreading in many places. Much investigation has been devoted to possible means of eradicating bracken and many experiments have been carried out upon methods for control of the weed. The main practical difficulty, however, is the question of cost, as the land on which it grows is of limited value and very heavy expenditure on clearing the ground of bracken is not an economic proposition. On the whole cutting appears to be the method of most general applicability, and the article by Professor Braid on p. 121 of this issue of the *Journal* deals in detail with that aspect of the subject.

Some tests for the control of bracken by herbicides have also been carried out, and promising results have been obtained in certain districts by spraying with a 5 per cent solution of sulphuric acid and by treatment with sodium chlorate at the rate of 1 to 1½ cwt. per acre. Expense, however, is a limiting factor to the extended use of this method.

**Drainage, etc.**—Brief mention may be made of some other methods of maintaining good grazing on hill ground. Surface drainage of wet places which carry a herbage of rushes and coarse grass will promote increased grazing and the production of a finer herbage. On the other hand the drier slopes which generally carry a stunted heathery vegetation or a poor thin grassy herbage will benefit by being artificially flushed with hard spring water where a convenient supply is available. This encourages a closer, more grassy herbage, and such areas are notably well grazed. Where it is possible to graze hardy cattle on hill ground during the summer months much improvement can be effected on the rougher types of grassy herbage, since cattle will graze down the rougher grasses more readily than sheep. The presence of cattle on a hill pasture will also assist in the control of bracken, as they trample and break down many of the fronds.

# RECLAMATION AND CULTIVATION OF PEAT LAND IN LEWIS—V

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AND

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In previous articles in this *Journal* an account has been given of the establishment and first stages of development of a demonstration farm on peat land at Arnish Moor in the Island of Lewis.[1] Reference was also made to experimental work and to reclamation and other schemes outside the farm. These projects were made possible through the generosity of Dr T. B. Macaulay of Montreal, a Scots-Canadian whose ancestors came from Lewis, and the main reasons which led Dr Macaulay to undertake them were :—

1. The great areas of peaty and other semi-waste land in Scotland which are poorly utilised, the deterioration which is going on in many places in land which was formerly cultivated, and the fact that there was no moorland research station in the British Empire.
2. The special need for reclamation work and a demonstration centre in Lewis. There is a large crofting population in the island, and although there is a demand for further holdings and a need to increase the size of many existing holdings there is no land available in certain districts except moorland. Agricultural practice in the island is in a backward state, partly owing to the natural conditions and partly perhaps owing to the distance from demonstration centres. Milk production, in particular, was unsatisfactory, and in 1928 about half the milk supply of Stornoway was imported from the mainland.

The work done from 1929, when the conversion of a peat moss into a farm was commenced, until the end of 1932, has already been described. During the past two years the farm policy has been dictated largely by financial considerations, and the main problem has been to balance the budget. An endowment was provided by Dr Macaulay when the farm was established, but owing to the depression the revenue from the endowment dwindled, and the farm has temporarily had to depend more or less on its own resources. Expenditure on detailed experimental work had to cease for a time, and even urgent improvements and developments on the partly reclaimed farm had to be postponed. With additional resources much more rapid progress could have been made, not only in education and research, but in converting the farm into a self-supporting unit. The work about to be described is therefore an account of the agricultural development, with insufficient resources, of one of the softest areas of peat land in Lewis.

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[1] *Scot. Jour. Agric.*, vol. xiii., p. 121 (Apr. 1930); vol. xiv., p. 131 (Apr. 1931); vol. xv., p. 174 (Apr. 1932); vol. xvi., p. 218 (Apr. 1933).

I. **Work carried out during 1933.**—In the spring of 1933 the position was as follows. About 61 acres of moorland had been reclaimed or improved, of which 26 acres were under semi-permanent pasture and the remainder under temporary grasses, with the exception of small areas of stubble and fallow land. It had been intended, at anyrate during the first few years, to concentrate on pasture, hay and silage, with perhaps smaller areas of potatoes and vegetables, but even this presented difficulties. The making of roads through the farm had only been commenced, and in wet weather it was found impossible at times to get implements and manures out to the fields and to bring in the crops. Drainage in many parts of the farm was far from satisfactory, and this not only rendered cultivation difficult and expensive, but made it necessary to do most of the harvesting by hand. Further, it was not easy to obtain satisfactory casual workers. It was decided, therefore, to cultivate as little as possible until conditions improved.

The dairy stock in the beginning of 1933 consisted of 12 tuberculin-tested dairy cows and a bull, and the poultry stock of 80 one-year-old hens and 30 breeders.

*Cultivation, manuring and cropping.*—The temporary grass was situated in the central area of the farm and most of the ground there was too soft for grazing by cattle. Part of this grass required renewing if it were to be cut for hay, and the stubble and fallow ground had also to be cultivated. Most of the previous cultivation work had been done by the rotary moorland cultivator (the Lanz Fräse), but the machine was in another part of the island and was not available. The peat had not reached a fit condition to enable a plough and horses to be used, and the rotary harrow (Hankmo) was therefore employed. Reference has previously been made to this implement.[1] On the stubble and fallow land it proved very successful, cutting and pulverising the peat quite efficiently. On the old grass the results were not so good, and some of the tougher patches were not properly broken up. Oats and a grass-seed mixture were sown in this area; owing to the inadequate cultivation the oat crop was somewhat patchy, but the grasses and clovers established themselves successfully.

The manurial mixture used on most of the farm in 1933 consisted of 2 cwt. slag, 1 cwt. potash salts, and 1 cwt. nitrate of soda per acre, and this gave a good result on both hay and pasture. Parts of certain fields received farmyard manure at the rate of 12 tons per acre, and this showed a marked improvement over the artificial dressing. Similar results were previously obtained with farmyard manure and fish offal, and it would appear that organic manures have a particularly beneficial effect on recently reclaimed land, probably through the stimulation of bacterial activity.

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[1] *Scot. Jour. Agric.*, vol. xv., p. 176 (Apr. 1932).

In portions of two fields recently reclaimed but not limed, an attempt was made to grow crops with a fairly heavy dressing of the artificial manure mentioned above. Oats and a grass-seed mixture were sown, but the yield of oats was light and although the grasses did quite well, in the following year clover was practically absent. The application of lime or shell sand would appear to be necessary on this peat land in order to obtain satisfactory results, even though basic manures are used.

*Results.*—The hay crop in 1933 was light and a spell of bad weather which began in mid-July interfered with its harvesting. The yield was estimated at just under a ton per acre. The oat crop was fairly good, but did not ripen well and much of it was damaged in harvesting. Owing to the softness of the ground the cows had to be taken off the pasture early in September. The materials grown on the farm, together with purchased concentrates, were sufficient to maintain them until about the middle of February.

The output of milk was maintained at from 20 to 25 gallons per day, and most of this was bottled and sold in Stornoway and Harris. During the year the poultry stock was increased to about 140. The total receipts for the year ending 31st March 1934 from milk, poultry and sundry sales, amounted to £1127, 14s. 6d., and the total expenditure, excluding depreciation on buildings, tractors, and implements, amounted to £1171, 17s. 5d. The details are as follows :—

| | | | | | | |
|---|---|---|---|---|---|---|
| *Receipts*— | | | | | | |
| Milk Sales | £1077 | 9 | 5 | | | |
| Sundry Sales | 7 | 6 | 7 | | | |
| Poultry—Credit Balance at end of year | 42 | 18 | 6 | | | |
| | | | | £1127 | 14 | 6 |
| *Expenditure*— | | | | | | |
| Wages and travelling expenses | 368 | 5 | 9 | | | |
| Seeds, fertilisers and feeding-stuffs | 382 | 4 | 3 | | | |
| Dairy maintenance | 122 | 6 | 3 | | | |
| Upkeep of tractors, plant and implements ; petrol, oil, etc. | 154 | 16 | 5 | | | |
| Building repairs, sundries, insurances, freights, etc. | 102 | 9 | 0 | | | |
| Depreciation on stock (cattle) | 41 | 15 | 9 | | | |
| | | | | £1171 | 17 | 5 |

**II. Work carried out during 1934.**—In 1934 the work of the farm was continued on practically the same lines as in 1933. With the exception of about three-quarters of an acre of land near the steading (intended for a vegetable garden) on which mashlum, turnips and cabbages were grown, the whole farm was under hay and pasture.

As there was a good demand for milk, efforts were made to increase the output. The less productive cows were replaced by better animals, and during the summer of 1934 the daily production of milk was increased to 30 gallons and maintained at or above this figure during the autumn and winter. The poultry stock was increased to 160. At the end of August, 71 sheep (mostly cross lambs) were purchased to eat the second growth after the hay was cut. The ground was very soft, but most of the animals did well, and for the first six weeks put on weight rapidly. The average purchase price was about 17s. 6d., and by the middle of February more than half had been sold at an average price of 30s. per head.

As much road-making and drainage work as could be afforded was undertaken during the year. The peat road described in a previous article[1] was so satisfactory that an additional 400 yards of road has been constructed on the same lines.

The transport problem was solved to some extent by the use of a cart fitted with Dunlop wheels and pneumatic tyres and drawn by a caterpillar tractor. It has been found possible to use this on very soft peat land on which an ordinary vehicle would have sunk up to the axles. Before the Dunlop-equipped cart was used, all the materials on the farm had to be conveyed on a sledge, which damaged the surface over which it was drawn. The cart body was designed by Mr J. A. Chisholm of Robert Gordon's Technical College, Aberdeen, and by means of this pneumatic-tyred vehicle heavy loads can now be conveyed across the soft peat land at a much lower cost than was possible with a sledge.

*Cultivation, manuring and cropping.*—The small area of land cropped in 1934 was cultivated by means of a small roto-tiller previously used for garden work at the headquarters of the Macaulay Institute. The machine has a 5 h.p. two-stroke air-cooled petrol engine and various implements can be attached. The cultivating equipment consists of revolving tines which break up the ground to a depth of 7 or 8 ins. It worked very efficiently on the peat land, but where there was a tough sole of grass; or where the ground was being broken for the first time, it was scarcely powerful enough, and the tines were not sufficiently strong. A machine of this kind is very economical to run, and a slightly larger type, with tines or knives designed for peat work, would be exceedingly useful. On very soft ground wheels of the caterpillar type would be advantageous. There might be disadvantages, however, in using a roto-tiller regularly for cultivation if the land were weedy, as it breaks up but does not turn over the ground.

The same machine was used in the autumn to cultivate about six acres of grassland which was being broken up, and with the mowing attachment, it was used for cutting about twenty acres of hay. Owing to the uneven nature of the ground, the mowing was not as close as might have been desired, but the use of the machine effected a big saving in harvesting costs. Under favourable conditions a man mowed four acres a day on about two gallons of petrol.

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[1] Ian M. Robertson, B.Sc., Ph.D. "Peat Mosses," II, *Scot. Jour. Agric.*, vol. xvi., p. 160 (Apr. 1933).

The amount of artificial manure applied was greatly reduced in 1934. Samples from the various fields were tested, and it was found that in most cases sufficient lime, phosphate and potash were present for hay and pasture. A dressing of nitrogenous manure was given in the beginning of May and to some areas a second dressing was applied in June. The mashlum area received a basic slag mixture.

*Results.*—The mashlum (oats, beans, peas, and tares) was an excellent crop, all the legumes doing well, and it was fed green in the autumn. It would appear that with suitable treatment mashlum can be grown successfully on this peat land. The cabbages were a moderately good crop, but the turnips were a failure owing to drought at the time of sowing. The hay crop was very satisfactory, but almost continuous wet weather from early July onwards interfered with harvesting and part of the crop was damaged.

III. **Future Policy.**—The land improved or cultivated at the farm is at present almost entirely under grass and the condition of some of this land leaves much to be desired. The drainage system in particular is unsatisfactory and in many places requires to be thoroughly overhauled. When this is done and further roads are made, more of the land will be kept under cultivation, with a view to producing an adequate supply of silage and green forage crops. Further experimental work on many lines is desirable, particularly on drainage problems.

IV. **Grass and Clover Plots.**—Small plots of grasses, clovers and other pasture plants were sown in 1931[1] on peat land which had been cultivated and had received a dressing of artificial manure containing nitrogen, phosphoric acid and potash. Half of each plot received a dressing of shell sand. The purpose of the test was to obtain a general idea of the growth and persistence of the various species when sown separately.

In the autumn of 1934 it was found that on the sanded portions of the plots the majority of the forty varieties had persisted. The following appeared to be most vigorous : timothy, cocksfoot, New Zealand cocksfoot, Kent evergreen perennial ryegrass, crested dogstail, smooth-stalked meadow grass, wood meadow grass, fine-leaved fescue, red fescue, Chewing's fescue, hard fescue, sweet vernal, wavy hair-grass, yarrow, and wild white clover. Bird's-foot trefoil and late-flowering red clover did moderately well. Most of the varieties failed on the areas that had not received shell sand, but reed canary grass, New Zealand bent, South German bent, and meadow fescue appeared to be more tolerant of acid conditions than most of the others. Further experiments are required, however, before these observations are confirmed, and when financial conditions improve, it is proposed to carry out more elaborate tests.

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[1] *Scot. Agric. Jour.*, vol. xvi., p. 222 (Apr. 1933).

V. **Reclamation in other parts of Lewis.**—Part of the function of the Macaulay Demonstration Farm was to serve as a centre for assisting reclamation schemes throughout the island. The implements and machinery obtained for the farm were selected with this end in view, and when these can be spared they are loaned to crofters who wish to reclaim land on the understanding that they pay wages of a driver (if a tractor is used), running expenses, and breakages.[1] A considerable desire has been expressed for assistance of this kind. The occupiers of one of the new settlements created by the Department of Agriculture for Scotland in the Ness district borrowed a tractor and moor plough and reclaimed about 50 acres during the winter of 1933-34. Similar work has been done on new holdings at Laxdale, near Stornoway, and elsewhere. There are further applications from various individuals and groups of crofters, and there appears to be scope for much useful work in this direction. Without mechanical aids much of this reclamation work is so laborious that it would not be undertaken. The crofters have shown that they are quite prepared to pay the wages of a driver and the running expenses, but the assistance given would be still more valuable if a greater range of implements were available, as both skinned land and peat have to be dealt with.

VI. **Poultry Development.**—Further important progress has been made in the scheme for the development of a poultry industry in Lewis. The preliminary stages have already been described,[2] and in December 1933 a co-operative society was formed to carry on and extend the activities of the Macaulay Scheme. The membership of the society is over 200, and the annual turnover of eggs, which was 10,000 dozen two years ago, now exceeds 24,000 dozen. New premises have recently been acquired for the egg-grading depot, and it is hoped that there may eventually be established there a packing station under the scheme for the reorganisation of egg-marketing in Britain. The quality of the stock kept by crofters all over Lewis has greatly improved since pure-bred Rhode Island Reds were introduced. In a few centres this breed is now very popular in the island.

VII. **Review of the effects of the Macaulay Schemes in Lewis.**—It may be of interest to review briefly what has been achieved during the six years since work was commenced on the peat bog which is now the Macaulay Farm.

1. An experimental and demonstration centre on peat land has

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[1] For the financial year 1934-35 a grant was received from the Department of Agriculture for Scotland to cover breakages and cost of transport to and from the Macaulay Farm.

[2] *Scot. Jour. Agric.*, vol. xv., p. 183 (Apr. 1932); vol. xvi., p. 224 (Apr. 1933).

been established, the value of which is not confined to Lewis.

2. The farm has demonstrated some of the possibilities of land reclamation and improvement in Lewis itself, making use of the island's resources in shell sand, fish offal, and seaweed, and the widespread need for phosphatic manures has been shown.
3. Reclamation in various parts of the island has been assisted by the loan of tractors and implements, and by techincal advice.
4. The milk supply of Stornoway has been increased in quantity and improved in cleanliness. It is estimated that, through the stimulus of the farm, at least 170 gallons more milk is produced daily than in 1928, and the island is thus saving over £3000 per annum. The methods of handling milk have been improved, and whilst there were few, if any, tuberculin-tested cows in Lewis in 1928, there are now over 150.
5. The poultry stocks of the island have been greatly improved and increased, and the marketing of eggs has been put on a co-operative basis.
6. The facilities for agricultural education in this backward agricultural area have been very much improved.

In conclusion, acknowledgment is made of the very valuable and whole-hearted co-operation of the North of Scotland College of Agriculture, without which the work could not have been carried out.

# MECHANICAL TREATMENT OF ROUGH HILL PASTURE

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In a previous paper [1] an account was given of experiments in the improvement of hill pasture that have been carried on at Boghall, the experimental farm of the Edinburgh and East of Scotland College of Agriculture. It was there shown that, while certain types of herbage were responsive to treatment with phosphatic manures, there were other types which showed little or no response to such treatment, and certain possible reasons for this failure to respond were suggested. One of these suggested causes was the very bad mechanical condition of the surface layers of the soil. In all the unresponsive types of herbage the soil was covered with a thick tough mat of partially decayed plant remains, and it appeared probable that this interfered considerably with the action of manures and encouraged inferior surface-rooting plants. Another reason suggested for the failure of manures to induce any improvement in the herbage was the absence or scarcity of superior herbage plants, notably of wild white clover.

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[1] R. G. Heddle and W. G. Ogg. "Experiments in the Improvement of Hill Pasture," *Scot. Jour. Agric.*, vol. xvi., p. 431 (Oct. 1933).

In order to test these hypotheses and to investigate the possibility of improving the herbage by mechanical destruction of the mat and the introduction of better herbage plants, an experiment was started in the winter of 1932. The object of the experiment was twofold, firstly to investigate the effect of tearing up the surface mat and introducing new species upon the character of the herbage, its grazing value and its response to manurial treatment, and secondly, to compare the effects of different types of cultivating implements.

For the purpose of the experiment an area of the herbage described as "Nardus with Undergrass" was chosen. An account of the character of this type of herbage will be found in the paper referred to above. It is one of the types which had previously proved very unresponsive to manurial treatment and is characterised by abundance of *Nardus stricta*, the "mat grass" or "white grass," with an associated grassy herbage consisting mainly of bent grass (*Agrostis spp.*). There is a thick surface mat and the underlying soil is highly acid and extremely poor in "available" phosphate.

The area chosen for the experiment was about two acres in extent and was fairly uniform in herbage apart from a section (part of Plot 4) which was subject to some surface flushing and carried a herbage somewhat intermediate in character between typical "Nardus with Undergrass" and "Wet Flush Pasture." On this section sedges (*Carex spp.*) were prominent and wild white clover was present. The ground was intersected by a series of parallel sheep drains and these were utilised to mark the boundaries of the plots.

**Traction.**—The track leading from the farm to the experimental area has a very soft surface in wet weather, and at several places it rises sharply. In order to overcome these difficulties it was decided to employ a track-laying tractor of medium power when transporting the implements up the hill. All the traction was done in a very satisfactory manner by a Model T-20 Tractractor.

**Experimental Treatments.**—Four implements were chosen for the experiment and a plot was allocated to each, the operations being carried out at the beginning of November. In the following February phosphatic manures were applied to the plots, and in the middle of May seeds were sown on the whole area. Commercial seed cleanings were employed for the purpose and the seeding was at a heavy rate, about 1 cwt. per acre. About two-thirds of this would consist of perennial ryegrass, one-fourth of Yorkshire fog, and the remainder of wild white clover, crested dogstail, and small amounts of other species.

The implements used and the manures applied to the various plots were as follows :

Plot 1. " Climax " Super Cultivator ;
12 cwt. per acre ground mineral phosphate.
Plot 2. " Tandem " Disc Harrow ;
16 cwt. per acre basic slag.
Plot 3. Pitchpole Pasture Cultivator ;
8 cwt. per acre ground mineral phosphate.
Plot 4. " Dauntless " Cultivator ;
12 cwt. per acre basic slag.

The implements used on Plots 1, 3 and 4 were fitted with grassland points, and may be classified in general as " ripping " devices, while in contrast to these, the disc harrow used on Plot 2 had a spading action. All the plots were cultivated lengthwise and diagonally until the fibre-bound surface was thoroughly broken up. No attempt was made to collect the loose material on the surface, as it was considered sufficient to allow it to dry and rot away or be blown off by the wind.

**Work of the Implements.**—The " Climax " Cultivator cut through the mat effectively, but the variations in the contour of the ground, together with its unevenness, were too severe a test on the tine-compensating mechanism, and consequently the cultivation was patchy. The mat was ripped out in large clods, and of the resulting surface on all the plots, that on Plot 1 was the roughest. The compensating mechanism effectively prevented breakages, but the design of the machine proved unsuitable for the work being done.

The Tandem Disc Harrow was adjusted for maximum penetration. The outside discs of the front gangs penetrated to the greatest extent but, owing to side pressure, the inner discs tended to rise. The implement weighed about 14 cwt. and the average depth of penetration was about two inches. Penetration was improved by loading the weight-trays, but in order to cut effectively through the mat, the ground had to be cultivated more often with this machine than with the others. This implement left the least amount of rubbish on the surface.

The Pitchpole Cultivator was adjusted to penetrate to an average depth of from three to four inches. The draught was obviously very high with this setting and a large amount of mat was ripped out. On uneven ground the implement was insufficiently flexible to follow the contours. The machine cultivated twice lengthwise and once obliquely, during which process the surface became so loose that the tines choked more frequently and were only partly cleared by the self-clearing movement of the points, so that the tines were unable to penetrate the mat effectively. The rigid attachment of the tines to the crossbars was the cause of several points being broken when boulders were encountered.

The "Dauntless" Cultivator cut steadily through the mat to an approximate depth of four inches. The plot was cultivated twice lengthwise and once obliquely. On the second and third cultivations large clods of turf were torn out and a very rough surface was produced. The implement was fairly flexible on uneven ground, but the spring-mounted tines occasionally had not sufficient clearance left to ride over boulders, with the result that the implement was either forced out of the ground, or, as happened in one case, a tine was broken. A safety coupling could have been used with advantage. The self-lift mechanism worked very well.

**Influence of Mechanical Treatments on the Herbage.**—The dry season of 1933 was not highly favourable to the growth of seedlings. Nevertheless during the summer a distinct improvement was visible in the herbage and it was observed that the sheep were greatly attracted to the plots and spent a good deal of time on them. The effect of this was seen in the grazing, as the experimental plots were notably well grazed and greener than the surrounding untreated area. This was more particularly the case with Plot 2 which was distinctly less rough than the others, having fewer loose clods on the surface and fewer coarse tufts of grass. Examination of the plots in September showed that there had been a good take of Yorkshire fog and the seedlings appeared strong and well-grown. White clover was rather scarce, although the plants appeared quite healthy. It is probable that the seeding of wild white clover could with advantage have been considerably increased. The sown species had established themselves best on those parts of the plots where bare soil had been exposed. Perennial ryegrass, although it contributed largely to the seed sown, proved very unsuccessful in establishing itself. A few plants were present, but they were small and had not the vigorous appearance of the Yorkshire fog seedlings.

The initial improvement was well maintained in the following season, but it was obvious that the treatments had not all been equally effective. Of the four plots, Plot 2 was distinctly the best. More soil had been exposed on it, and this had formed a seed bed for the sown species which had established themselves well. Yorkshire fog was abundant all over the plot and white clover, while not abundant, was well distributed throughout, and the plants appeared healthy and likely to spread. *Nardus* had been more reduced on this plot than on any of the others, and the plot was well grazed. It was noted while the implements were working that the disc harrow cut out a good many plants of *Nardus*, severing the roots just below the soil surface, and this seems to have been a most effective method of eradication. Some of the loose material torn out during cultivation was still present on the surface of the plot.

Plot 3, on the other hand, was the least successful of the series. The mat had been less effectively dealt with than on the other plots and was still more or less unbroken in parts. *Nardus* was more abundant and the plot in consequence rougher and less well grazed. Less bare soil had been exposed and the establishment of sown species was poorer. Yorkshire fog had established itself fairly well, but white clover was poor.

Plot 4 still had a fair number of clods on the surface, but the roughness had been a good deal reduced and there was less *Nardus* than on Plot 3, though more than on Plot 2. Yorkshire fog had established itself well and white clover plants were frequent and appeared strong and healthy. Part of this plot, as noted above, had originally a much more clovery sward than the rest of the experimental area, and this portion had responded well to the treatment, carried abundant white clover, and was well grazed except for a few rough tufts of *Nardus*.

Plot 1 was less even than the others. Some parts had been well torn up, but others had been more or less completely missed and the plot had in consequence a patchy look. Where the mat had been well ripped up, Yorkshire fog had established itself well, but white clover was not very prominent. The surface was rather rough and cloddy, the plot being in this respect the worst of the series. The general result on this plot was not so good as on Plot 4.

A botanical analysis of the plots was made in June and the results are given in the table below. The analysis was made by the " Point " method [1] and the figures represent the percentage of the ground covered by the various species.

TABLE I

*Botanical Composition of Mechanically-treated Pasture Plots*

| | Plot 1 | Plot 2 | Plot 3 | Plot 4 |
|---|---|---|---|---|
| Mat grass (*Nardus stricta*) . . | 11·0 | 4·5 | 20·5 | 9·3 |
| Bent grass (*Agrostis spp.*) . . | 37·3 | 43·0 | 41·7 | 31·0 |
| Yorkshire fog (*Holcus lanatus*) . | 13·0 | 14·7 | 5·3 | 9·5 |
| Sheep's fescue (*Festuca ovina*) . | 4·0 | 6·0 | 4·7 | 4·0 |
| Sweet vernal grass (*Anthoxanthum odoratum*) . . . . . | 1·7 | 1·5 | 2·3 | 3·0 |
| Other grasses . . . . . | 2·0 | 1·5 | 2·0 | 5·5 |
| White clover (*Trifolium repens*) . | . . | 0·3 | . . | 7·7 |
| Miscellaneous plants . . . | 8·5 | 7·0 | 14·7 | 13·0 |
| Bare ground, moss, and dead material . . . . . | 28·0 | 25·0 | 13·2 | 21·3 |

The analytical results confirm the conclusions drawn from general observation of the plots and emphasise the different results which the various treatments have produced. The figures for *Nardus* are particularly striking, more than four times as much of this species being present on Plot 3 as on Plot 2. This largely accounts for the differences in appearance between the plots, the coarse, wiry stems of *Nardus* being neglected by the sheep.

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[1] E. Bruce Levy and E. A. Madden. "The Point Method of Pasture Analysis," *New Zealand Jour. Agric.*, vol. xlvi., No. 5 (May 1933).

In general it may be said that any treatment which has the effect of encouraging the better hill grasses, such as Yorkshire fog, bent grass, etc., at the expense of *Nardus*, will constitute an improvement of the herbage, producing as it does more succulent and palatable grazing and more winter-green pasture. Judged from this standpoint the experiment has certainly been a success. Whether it would be profitable to employ such methods of improvement in practice would probably depend to a great extent on local circumstances. It is not possible in an experiment of this type to assess the value of the improvement in terms of carrying capacity of the pasture or live-weight increase of the sheep, and the cost of treatment would vary widely according to local conditions such as accessibility, etc. It must thus remain a matter of personal judgment whether in any particular case the expenditure incurred in treatment would be a profitable investment. Where any considerable extent of the more easily improved types of pasture is present, *i.e.* the spring-flushed grassy swards of bent grass and Yorkshire fog with admixture of white clover, it would clearly be to these that attention should first be paid, but if this type of pasture is scarce or lacking, then it might well prove profitable to attempt the improvement of the rougher, poorer *Nardus* herbage. In any case, in view of the widespread occurrence of this inferior grass in hill pastures, it is of interest to know that pasture dominated by it is capable of considerable improvement by mechanical means.

## PLANT PATHOLOGY

*Notes from the Botany Department, Edinburgh and East of Scotland College of Agriculture*

J. A. Macdonald, B.Sc.

**The Resistance of Marrowstem Kale to Finger and Toe.**—In the spring of 1934 the writer communicated with the National Institute of Agricultural Botany with a view to ascertaining the existence, or otherwise, of distinct strains or types in marrowstem kale. The reply received indicated that the work of the Institute had already shown that there were seven such strains, and that these were obtainable from seed-growers or merchants in this country. Seed of the seven strains was therefore obtained, with a view to testing their resistance to finger and toe (*Plasmodiophora brassicae*). It has been shown that other species of cruciferous crop plants contain strains which appear particularly resistant to finger and toe, *e.g.* the Bruce among purple-top yellow turnips (1) and Weisse Wester among kohl rabi (2).

It is already widely accepted that marrowstem kale shows a high degree of resistance to finger and toe. No figures produced experimentally in support of this idea have, however, come to the notice of the writer. The trials, details of which follow, were carried out at the College garden at Liberton in naturally infected soil, to which had been added small quantities of infected turnip material from the Plant Registration Station and infected soil from the College farm at Boghall.

A preliminary test was carried out, in which commercial stocks of green marrowstem kale, purple marrowstem kale, kohl rabi, thousand-headed kale, swede, and the Bruce turnip were all obtained from the same source and the seeds sown out in duplicated rows. Ten weeks after sowing, about one hundred plants of each were examined and the percentage of infection was determined as follows :—green marrowstem kale, nil ; purple marrowstem kale, 8 ; thousand-headed kale, 6 ; kohl rabi, 22 ; swede, 25 ; the Bruce, 5. These figures bear out the general impression that green marrowstem kale shows a high degree of resistance. It must be remembered, however, that the period of the test was very short.

A trial was then made with the seven varieties of green marrowstem kale first mentioned, together with the green and purple kales included in the first test. The trial was in triplicate, two sets of nine rows being sown about the middle of May and the third set about mid-July. They were all thinned after one month, the thinnings being inspected for finger and toe. The crops were lifted for examination four and a half months from the date of sowing. In this way about one thousand plants of each strain were examined, counting all the stages. At the time of thinning very few plants showed signs of infection. The final percentage of infection in the later-sown part of the trial was very much higher than in the two earlier-sown portions. The average percentages of infection produced are given below.

| | |
|---|---|
| Green stem (trial one) | 22 |
| Purple stem (trial one) | 30 |
| Strain 1 | 19 |
| ,, 2 | 21 |
| ,, 3 | 22 |
| Strain 4 | 16 |
| ,, 5 | 28 |
| ,, 6 | 20 |
| ,, 7 | 20 |

The writer is fully aware that, having regard to the scale on which the trial was conducted, the percentages obtained cannot be accepted as definitely representing the degree of resistance ; nevertheless the range of infection from 16 per cent in Strain 4 to 28 per cent in Strain 5 does strongly suggest the possibility that resistance to finger and toe may vary as markedly among the seven strains as the other characters which have led to their distinction one from another.

It is intended to repeat and extend this trial in 1935 in order to obtain accurate comparative figures.

**The Effect of Excess of "Ceresan" and "Agrosan G" on the Germination of Wheat.**—It has been repeatedly remarked that seed dressing of cereals with preparations such as "Ceresan" and "Agrosan G" has a stimulating effect on the growth of the resultant crop. Sampson and Davies (3) have investigated the effect of

"Tillantan R" (Ceresan) on wheat germination, and attribute the beneficial results obtained entirely to the fungicidal action of the preparation. Chippendale (4), more recently, has arrived at much the same conclusion on treating with the same compound the seeds of cocksfoot, red fescue and tall fescue.

Neill (5), working in New Zealand, has drawn attention to the possibility of excess seed-dust interfering with cereal germination. He states that in certain types of continuous-action seed-dusting machines the dust employed may accumulate to such an extent that some of the grain receives about forty-two times the prescribed dressing. In the case of wheat grain treated with "Ceresan," germination was practically inhibited in these over-dressed samples. The germination remained practically unaffected when the dust employed was "Agrosan G." As careless handling of the dusts is a distinct possibility on many farms, it seemed worth while to confirm the results mentioned above.

Experiments were set up in the spring of 1934, in which untreated seed of the wheat variety April Spring Bearded was used. The untreated grain served as a control and the effect of "Ceresan" and "Agrosan G" was investigated. The tests were conducted (*a*) under the normal conditions of a laboratory germination test, *i.e.* the grain was placed on damp blotting-paper which received a uniform supply of water; and (*b*) by means of sowings in the open air under field conditions, except that the grain was protected by netting. Following Neill's method four hundred grains were employed in each sowing. Dustings at three, six, and forty-two times the prescribed rate were given, and untreated controls were also used in each series. The percentage of germination was determined in every case after three weeks. The results are given in the following table:—

| Treatment (No. of times prescribed rate) | Dust used | Percentage of Germination | |
|---|---|---|---|
| | | Lab. | Open Air |
| Untreated | .. | 97·25 | 91·0 |
| 3 | Agrosan G | 96·0 | 89·0 |
| 3 | Ceresan | 97·0 | 89·5 |
| Untreated | .. | 97·0 | 90·25 |
| 6 | Agrosan G | 97·25 | 89·0 |
| 6 | Ceresan | 96·75 | 90·0 |
| Untreated[1] | .. | 96·25 | 90·0 |
| 42[1] | Agrosan G | 88·5 | 88·25 |
| 42[1] | Ceresan | 85·25 | 45·0 |

These results serve to confirm Neill's findings up to a point. It will be seen that the only case in which a significant depression of the germination rate was produced was that in which "Ceresan" was applied in forty-two times the correct quantity; and in the field-test only. The germination was approximately 47 per cent lower than in the untreated sowings, and approximately 43 per cent lower than the " Agrosan G " treated samples. It is interesting to note that the laboratory germinations with these excessive treatments are not significantly reduced. In the laboratory trials every grain was removed as soon as the emerging radicle had reached a length of two millimetres. There is, therefore, no proof of the plantlets' ability to establish themselves. It was found, by digging up the soil in the open-air trials of seed treated with forty-two times " Ceresan " that many grains had germinated, though the resulting seedlings had failed to establish themselves. Large numbers of such seedlings were found showing short radicles and emerged plumules. All were dead. It would appear, therefore, that the " Ceresan " does not prevent germination altogether, but inhibits subsequent growth.

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[1] Average of two experiments.

There was no reduction in the germination of samples treated with six times the correct dressing of either " Agrosan G " or " Ceresan." This is a result of some interest also, as it indicates that no disastrous effects on germination rate need be feared from a slight accidental accumulation of excess dust.

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# NOTES ON THE CATTLE SITUATION IN SCOTLAND

R. G. M'CLYMONT, M.A., B.Sc. and A. STEWART, M.A., B.S.A.

THE primary purpose of the following notes on the cattle situation in Scotland is to present, in a form in which they are not already available, the statistical data relating to the marketing and prices of fat and store cattle during the twelve-month period March 1934 to February 1935.

The data relating to marketing and prices are those supplied by the Department of Agriculture's market reporters and refer to representative markets throughout the country. Prior to 31st March 1933 the number of markets from which information was obtained was nine; since then the number has been increased to ten.

The material is presented in graphical form in the accompanying

Chart 1. In the various series presented, the data relating to the year March 1933 to February 1934 are indicated by the solid line; those relating to the period March 1934 to February 1935 by the broken line. The curves indicated by the large dots represent the weekly averages for the appropriate months over the five-year period March 1930 to February 1935, and may be taken as an admittedly approximate indication of the seasonal movement including the trend. The period at which subsidy payments began is shown by the vertical line through the centre of the chart. The following notes are intended to indicate where the data for 1934-5 show any appreciable divergence from the normal movement and to suggest certain conclusions that seem to follow.

**Fat Cattle Marketed.**—In general, both the 1933-4 series and that for 1934-5 follow fairly closely what may be taken as the normal seasonal movement. The only marked discrepancy appears in the 1934-5 curve during the months of September and October and the first half of November 1934. Recorded marketings of fat cattle during this period were above both the normal and those in 1933. The occurrence of foot-and-mouth disease in Glasgow, which resulted in the closing of that market for a period of four weeks commencing 23rd January 1935, introduces an unfortunate complication. This factor resulted in recorded marketings during this period being lower than would otherwise have been the case. In its absence it is not unreasonable to suppose that the chart would have shown marketings in January and February 1935 to have been above normal, but probably not above the figures for the same months in 1934.

It appears from the returns of the numbers of " other cattle (one year and over) " on farms in June 1933 and June 1934, that there was little difference in the actual supplies of cattle available in the country.[1] Some other reason must therefore be found for the increase in recorded marketings after September 1934. Two possible explanations suggest themselves.

(1) The difference between the years 1934 and 1933 might be due to the premature marketing of cattle which would normally have been retained longer on the farm but which, after 1st September 1934, became eligible for the subsidy payable to animals meeting the requirements of a 52 per cent dressing test. If this explanation were to any extent correct there would later be a relative diminution in the rate of marketing. That the figures for January and February 1935 (even taking into account the effects of foot-and-mouth disease) approached more closely to those of the preceding year suggests that this factor was operative to some extent.

(2) In the second place the regulations relating to the payment of the subsidy, which require that for cattle to be eligible they

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[1] The actual figures published by the Department of Agriculture are: June 1933, 517,296 head, and June 1934, 516,693 head (*Abstract of Agricultural Returns for Scotland*, 1934).

CHART I

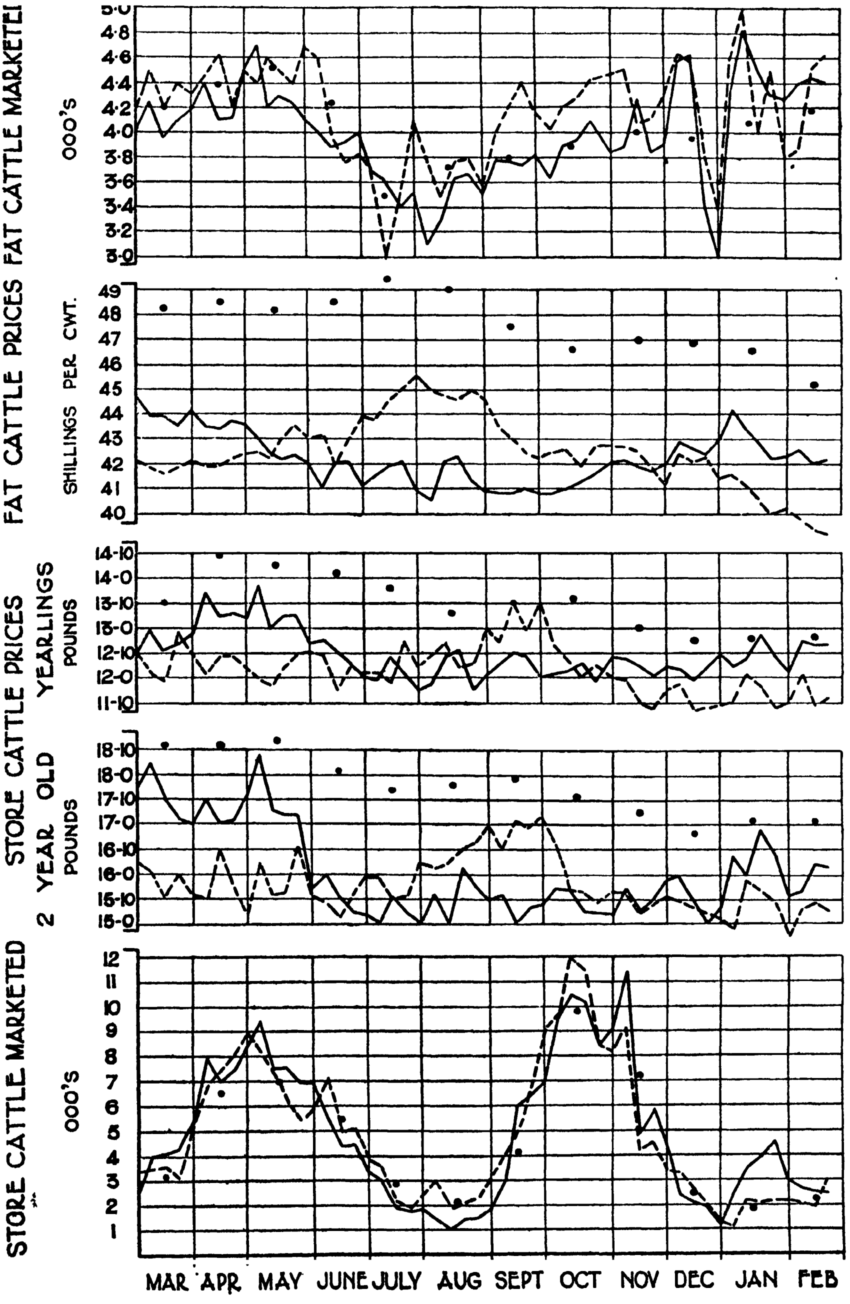
# FAT AND STORE CATTLE

WEEKLY MARKETINGS AND PRICES IN SCOTLAND

MARCH FEBRUARY

—— 1933-4 - - - 1934-5

• WEEKLY AVERAGE PER MONTH 1930-1 TO 1934-5



(Q.B.) D.O.A.S

must be passed through approved markets, would tend to increase the recorded marketings. In so far as this occurred, and its influence on the statistics must be admitted, the recorded increase in marketings, while reflecting a more complete enumeration of supplies coming on the market, does not represent any increased pressure of supplies. On the whole it may be suggested that over the period from September 1934 the supply situation was substantially the same as in 1933, with some tendency to relatively heavy marketings in September and October.

**Prices of Fat Cattle.**—The serious decline in the prices of fat cattle since 1930 is indicated by a comparison between the curves of prices in 1933-4 and 1934-5, and the plotted averages for the five-year period. It should, however, be noted that, because of the difference in the scales used, no direct comparison can be made between the decline in fat cattle prices as illustrated in the chart and the decline in store prices. Comparing the curves for 1933-4 and 1934-5 with the typical seasonal variation, it is evident that while the movements in 1933-4 were quite abnormal, those in 1934-5 approached more closely to the normal, although the fluctuations were somewhat more extreme than usual. This is true of the midsummer rise in prices and the subsequent decline, the net result being that the relation between the price at the end of February 1935 and the five-year average was little different from the relation that held at March 1934.

The most significant feature of the curve of fat cattle prices in 1934-5 is undoubtedly the fact that it approximates so closely to normal. To the extent that this is true, it appears reasonable to conclude that the introduction of the subsidy payment did not, over the whole period, affect the market price obtained for fat cattle. In other words, viewed from this angle alone, the producers have received the full benefit of the subsidy. Although the divergences from the normal seasonal variation are not pronounced, they might be considered as having some significance. The explanation suggested by the chart would then be as follows. The anticipation of the subsidy payment led to a rise in prices in June and July which resulted in a relatively higher level of prices in July and August than would otherwise have obtained. After September the relatively severe decline which occurred could be attributed to the pressure of premature marketings. The fact that, while the supply situation was materially the same in 1934 as in 1933, the downward trend of prices was maintained, suggests the continuance of the decline in demand which would appear to have dominated the situation during the past few years.

**Prices of Store Cattle.**—Comparison of the curves of the prices of both yearling and two-year-old stores in 1933-4 and also in 1934-5 with the normal, suggests that, as in the case of fat cattle prices, the seasonal movement in 1934-5 corresponded more closely to normal than that in 1933-4. Here again, however, there is in both the 1934-5 curves a marked divergence from the normal seasonal movement during the months of September and October. The seasonal rise of prices during this period, in the case both of yearlings and of two-year-old stores, was more pronounced in 1934 than is normally the case.

The relatively high prices in these two months might be due to either (1) reduced supplies, or (2) increased demand.

(1) It will be observed that the seasonal fluctuations in the numbers of store cattle marketed in both 1933-4 and 1934-5 followed closely the normal monthly variation. There is some indication that, in the last two years, there has been an increase in the intensity of the seasonal movement, although the timing has remained substantially the same, but this would appear to have little bearing on the problem being considered here. With supplies of store cattle approximating so closely to normal, the rise in store prices in September and October 1934 cannot be explained by a shortage of supplies of stores.

(2) The most reasonable explanation for the higher prices of store cattle in September and October 1934 is an increased demand on the part of feeders. This might have come about in either of two ways: (*a*) It has already been suggested that some premature selling of fat cattle in September and October may have occurred and in some cases feeders might consequently have been looking for stores at this time in order to finish them off before the end of the subsidy period; (*b*) on the other hand, and this is probably of more importance, feeders normally buying in stores at this time, impelled by the prospect of increased returns on account of the subsidy, were prepared to, and did in fact, pay higher prices for stores.

It is, however, very significant that the relatively high prices of stores were only maintained for a comparatively short period. This suggests that, whether (*a*) or (*b*) or both occurred, first, the early optimism of the feeder quickly died down as fat prices continued on the seasonal decline; and second, that the total benefit to the sellers of store cattle over the whole period of the payment of the subsidy has been relatively slight. In the early stages some part of the benefit did accrue to the cattle-rearer or dealer, and in the absence of a compensating rise of prices for fat cattle, this benefit was obtained at the expense of the feeder who has cattle to sell at the present time. These latter will consequently obtain relatively slight advantage through the payment of the subsidy.

Chart 2 enables the analysis of the price situation to be carried one step further. The movement of wholesale beef prices during 1934-5 followed closely the movement of fat cattle prices with the same tendency to a somewhat extreme rise in June and July and correspondingly pronounced fall from September to February. Consequently it may be said that over the entire period of the year the fluctuations in fat cattle prices did not exert any material

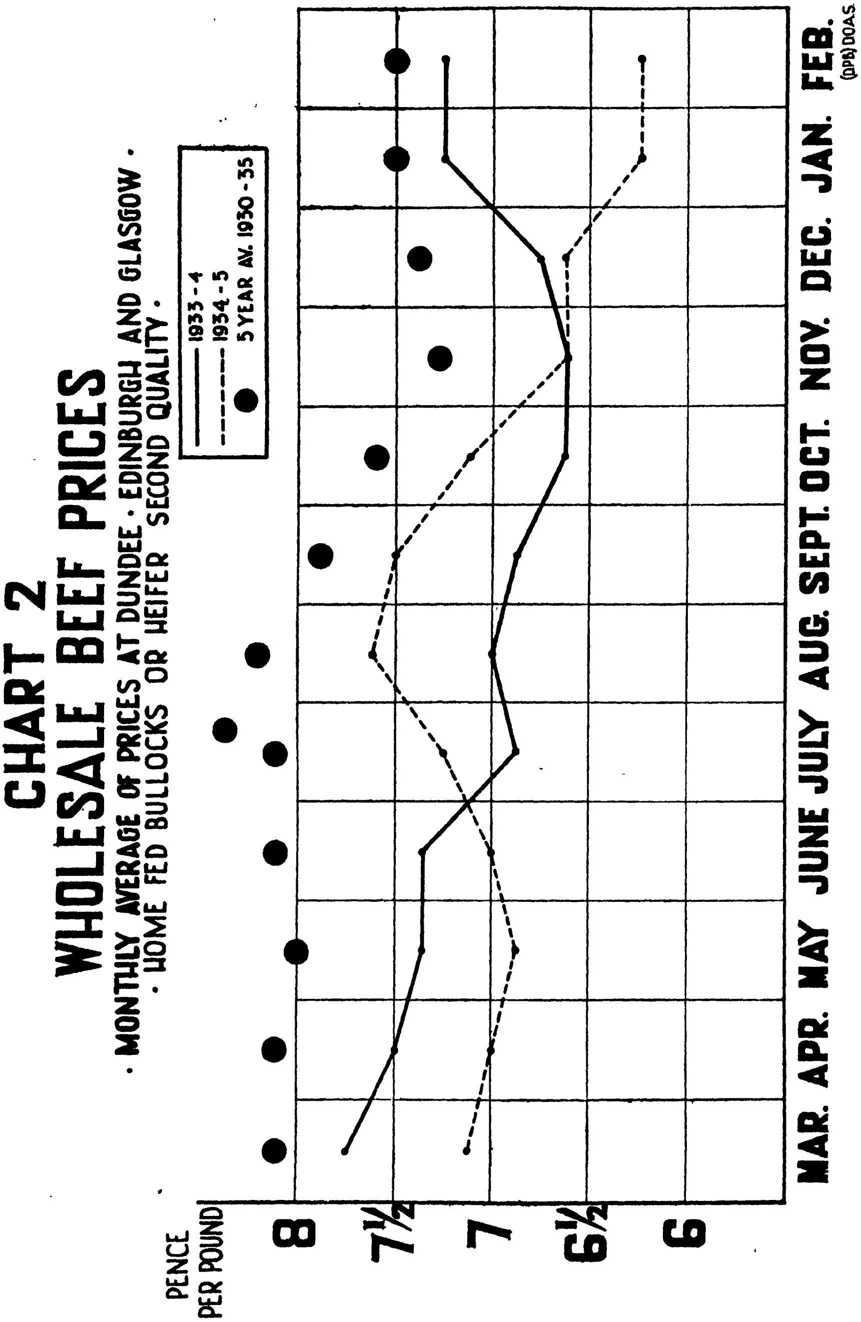


CHART 2

WHOLESALE BEEF PRICES

· MONTHLY AVERAGE OF PRICES AT DUNDEE · EDINBURGH AND GLASGOW ·

· HOME FED BULLOCKS OR HEIFER SECOND QUALITY ·

influence on the position of the wholesaler. There is some suggestion in the chart of a lag in the response of wholesale prices to falling fat cattle prices after August, which might represent an increase in the wholesaler's margin, but the total benefit derived could not have been great. Unfortunately the absence of adequate data relating to retail prices makes it impossible to pursue the analysis further and to suggest how far the effect of falling fat cattle and beef prices has been passed on to the consumer.

**Summary.**—The available statistical material suggests that:

(1) If the continued downward trend of prices is due to declining demand, the payment of the subsidy resulted in a net increase in the receipts of producers as a whole, equal to the amount of the subsidy.

(2) In so far as the payment of the subsidy tended to exaggerate the normal seasonal fluctuations, some producers of fat cattle gained relatively to others.

(3) The increase in store prices during the months of September and October 1934, which can be attributed to the subsidy, transferred a part, although a relatively small part, of the total subsidy to the feeder or dealer.

(4) In so far as the price of fat cattle was only slightly, and seasonally, affected by the payment of the subsidy, little, if any, of the benefit can have accrued to the middleman or the consumer.

(5) The problem of demand would appear to be the central issue in the cattle situation.

## The Identification of Potato Varieties by Chemical Tests

T. P. M'Intosh, Ph.D., B.Sc.

Two articles (1) (2) have already appeared in this *Journal* describing work carried out to determine the extent to which chemical tests could be used in the identification of potato varieties. As a result of these tests, it was found possible to group varieties, but not to isolate and identify individual varieties. In view of the fact, however, that since the publication of the second article, chemical tests have been used in connection with legal and other cases involving disputes as to the identity of potato varieties, it appeared that further work might be done on the subject in order to ascertain whether more accurate identification were possible. The following is a description of some preliminary work done in this direction.

Before new tests were tried, an endeavour was made to determine whether or not it was possible, by means of the tests which had been applied to tubers, to differentiate between the flowers of the various white-flowering varieties. It was found that the alkali test, described in the first article, did indeed give positive results. Thus, the white petals of the variety, Abundance, turn only slightly yellow when treated with a dilute solution of caustic potash, whereas those of Majestic, similarly treated, become dark orange in colour. So far, the varieties that may be separated in this way are readily distinguished by other characters; hence, in its application to growing plants, this test has more interest than value.

The most satisfactory of the new reagents applied to differentiate the tubers of the various varieties was found to be the oxidation—reduction indicator, phenol-indo - 2 : 6 - dibromo-phenol. The technique adopted was as follows:—(1) Mature tubers of approximately the same size were selected from the varieties to be tested; (2) from the middle of each tuber, and as far from the eyes as possible, cylinders of tissue were taken by means of a cork-borer; these cylinders were cut to equal lengths, each possessing approximately the same quantity of cortex and pith; (3) each cylinder of tissue was boiled in water for five minutes, test-tubes being used for the purpose; after boiling, the liquid was poured off and the tissue was allowed to cool; (4) finally, when the cooling process was finished, equal quantities of the indicator were added to each test-tube. After a short time the strongly-reducing varieties clarified the blue indicator, whereas the weakly-reducing varieties left the colour unchanged. After a longer time, however, even weakly-reducing varieties may clarify the indicator. Extractions with acetic acid and trichloracetic acid gave similar, but not so pronounced, results.

Extensive tests were made with the varieties King Edward and Majestic, not because these varieties are liable to be confused, but because their tubers can be readily obtained. Constant differences were found, thus indicating that environmental factors are not sufficiently important to affect the results seriously, so far as these two varieties are concerned. By inference, they probably will not interfere with the results obtained with other varieties. Of the other varieties tested, insufficient samples were available to enable the results to be stated in tabular form. Indeed, with more refined technique it is probable that more pronounced differences will be found than appear at present; tabulation is therefore undesirable until more extensive tests have been made. It is hoped that the matter will be further investigated next season.

In the article mentioned in reference (2), numerical values were given to express the activity of oxidising enzymes. It will be observed that these figures give apparently a rough-and-ready measure of the susceptibility of the various varieties to mosaic diseases, the varieties with the highest values being the most susceptible. The varieties with intermediate values react variously and, as of these the most susceptible to mosaics appear to be the least reducing, it is now suggested that the oxidation-reduction balance may give a measure of the susceptibility of any variety to these diseases. Resistance to virus diseases has probably a physiological basis and it is quite likely that it can be measured by chemical means. It is hoped that this matter will be further investigated next season, as, should the oxidation-reduction balance have the significance suggested, the problem of the control of virus diseases in the potato will become simplified: breeders will be able to discard susceptible seedlings, just as they do at present with regard to wart disease, and the disappointments which growers have experienced in the past with regard to some new varieties will cease to occur.

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# Musk Rats in Scotland

An article under the above heading was published in the issue of this *Journal* for January 1934. The following is a record of the progress made during 1934 in the campaign for the destruction of these animals.

During 1933 the staff of trappers was increased from four to thirteen and a supervisor, and remained at that number during 1934. The number of musk rats killed in 1933 was 764, while in 1934 only 154 were accounted for. The numbers month by month are shown below.

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1933 | 14 | 47 | 72 | 51 | 51 | 57 | 40 | 78 | 135 | 104 | 62 | 53 |
| 1934 | 27 | 19 | 13 | 11 | 17 | 19 | 9 | 5 | 10 | 4 | 13 | 4 |

The fluctuations in the numbers killed are more easily compared by taking the totals for each half-year:

| | | |
|---|---|---|
| 1933 | First half | 292 |
| | Second half | 472 |
| 1934 | First half | 106 |
| | Second half | 48 |

From these figures it is evident that early in 1933 there were not sufficient trappers to control the natural increase of the musk rats. As the staff increased and became more efficient the breeding stock and young animals were being trapped at a much greater rate than the natural rate of increase. Musk rats were killed in the first half of 1934 at the rate of 4·0 per week, but in the latter half the average number killed per week was only 1·8. The majority were killed in the first three months of that year.

An instructive comparison can be made by taking the number of musk rats killed in the same areas in 1933 and 1934. The Ordnance Survey Sheets of Scotland, on the scale of one inch to the mile, are divided into squares of four square miles area, which are numbered and lettered. A square is taken as the unit of reference. If the numbers killed in a certain square in 1934 are compared with those killed in the same square in 1933, the success of the campaign in that square becomes apparent.

The infestation is greatest in the valleys of the Rivers Earn, Allan, Teith and Forth. The area bounded by the watersheds of these rivers can conveniently be divided into two portions, the upper containing the valleys of the Earn and Allan as far south as Dunblane, the lower including the Forth and Teith.

The upper portion contains the site at Feddal, near Braco, from which these animals have spread and which is the most heavily infested area in Scotland. In the Carsebreck area, square H.6, 127 musk rats were killed in 1933, while in 1934 only 17 were caught. A little farther down the Earn, in the Auchterarder area, squares E.10, E.11, E.12, 100, 98 and 41 musk rats were killed in 1933, whereas in 1934 the numbers were 14, 19 and 7. In the Stirling area, square C.3, 70 musk rats were killed in 1933, while in 1934 only 3 were caught.

In 1933 musk rats were killed in 38 squares, but in 1934 only in 23 squares; this means that musk rats in 1933 were active in 152 square miles of country, while in 1934 the area where they were prevalent had been reduced to 92 square miles and there were many less in that area.

It must not, however, be supposed that 152 square miles in 1933 or 92 square miles in 1934 formed the total area infested by musk rats. These animals pass through and harbour temporarily in a large part of the river valleys of Central Scotland; it is more correct to state that they may still be found anywhere within an area of 400 square miles.

Since October 1934, Mr T. Warwick, a biologist from the Bureau of Animal Population, Oxford University, who was in charge of the biological investigations of the musk rats caught in Shropshire, has been carrying on his researches in Scotland. He found that musk rats that had been living in ponds or still water for some time became infested with tapeworms, whereas those caught in the streams were free from these parasites. By this means it was possible to tell whether musk rats had recently arrived in a pond or had been living there for an appreciable period. The tapeworm found is an American species of this parasite; it must therefore have been brought over with the animals originally imported.

Musk rats are most elusive creatures. They appear to travel only at night and by water, and their spoor is very seldom seen. It may be known that one is living in a pond, yet the burrow it inhabits may not be discovered until the animal itself is caught in one of the many traps set in the vicinity. An instance of the elusiveness of these animals may be cited. At Gleneagles Golf Course there is an artificial pond known as Loch-an-Erie. At the end of August 1934 the trapper in this area reported that some old burrows in this pond appeared to be in use. Although traps were laid no musk rats were caught. A careful watch was kept, and at the end of October the trapper reported that there were no signs of these animals in the pond. About this time heavy flooding took place in the River Earn, and later there was a spell of very cold weather in which Loch-an-Erie was frozen over for some days. On 8th November another trapper, surveying in this area, noticed lines of air bubbles under the ice, which he knew from experience could be caused only by musk rats. Since that date seven have been killed in this pond, though none were found in it between March 1933 and November 1934. From the tapeworms found in these seven animals they must have been in the pond for some time, though it was thought that they had been driven out of their haunts on the river by the floods which preceded the frost. This instance shows the difficulty of locating musk rats and their ability to hide themselves even from men specially trained to track and capture them.

The large breeding stock and their progeny, which were in evidence in the latter half of 1933, exerted their influence in the early part of 1934, but later, as these older animals were killed off, it was only the younger and a few of the older animals that appeared in the traps. In some areas no musk rat has been caught for months, though reports of individuals having been seen by private persons in these areas are not uncommon. The fact that none has been killed in an area for some months is no proof that there are no musk rats in the locality. A watch will have to be kept for a considerable time to come on all places likely to harbour any of these animals.

Owing to the decrease in the number of musk rats in the country the physical work of trapping has also decreased. This has necessitated a reduction in the staff of trappers and further reductions will take place during this year if the progress of the campaign permits of this being done. The reduction of staff will involve a reduction in the number of areas and an increase in their size.

Though the actual work of trapping will be less, the need for inspection will have increased with the enlargement of the areas. To meet this need the trapping staff must possess greater mobility. It will be realised that adverse conditions, such as floods, dark or disturbed water and high winds, render it impossible to locate the entrances to burrows, which are always under water. The extra mobility conferred by the use of motor-cycles will enable the trappers to seize a favourable opportunity to survey a greater number of places than they would be able to examine with ordinary transport.

The stage is being rapidly reached where there is an intractable residue of animals that are most difficult to discover and to catch. Where these animals procure food from under water, store it in deep burrows and eat it there, or where they feed at a distance from their burrows, detection is rendered uncertain. Frequently their droppings are the only sure indication of their presence ; to look for these in a marsh or backwater is almost as hard a problem as hunting for a needle in a haystack. Still, it has been done successfully in the past and will be achieved again.

The intensive trapping has been successful to the point of breaking up almost all the family life which musk rats usually maintain. In the latter half of 1934 only three family groups were captured ; the others were all stragglers.

During the years 1933 and 1934 a large number of animals other than musk rats have been caught in the traps. With traps set in or near water the number of water voles killed, as might be expected, was large. Of these animals 2472 were caught. In some areas the trappers complained that they were unable to catch any musk rats until the majority of the voles in the locality had been killed.

Trappers visit their traps during the day, re-setting any that are sprung ; in vole-infested areas this was insufficient. As musk rats feed in the open only at night, the traps had to be visited in the evening to remove the voles with which, by that time, most of them were filled, so that they might be available for musk rats. Of brown or common rats 1856 were taken in the traps. An otter was trapped in the vicinity of Carsebreck ; a foot was left in a trap near that place and another in a trap in the River Forth, near the farm of Westleys. Fifty-one stoats and 61 weasels were trapped. The number of these animals killed led to an enquiry whether stoats and weasels hunted musk rats. The majority of the trappers were of opinion that these animals do not hunt musk rats specially, but that if a stoat or weasel met a young musk rat it would attack it. Amongst the animals which were unexpectedly found in the traps were a mole, an owl, a kingfisher, a grouse, and an eel.

## Reviews

*Dictionary of Terms relating to Agriculture, Horticulture, Cattle Breeding, Dairy Industry and Apiculture.* (In English, French, German and Dutch.) Compiled by T. J. Bezemer, London, 1934. George Allen & Unwin, Ltd., Museum Street. Price 25s.

This work is published under the auspices of the State Agricultural College, Wageningen, Holland, and has been compiled by Professor Bezemer in collaboration with many well-known Dutch authorities. It is the first dictionary of its kind in this particular field and, as the compiler points out, no claim of completeness is made : the most important words only have been included in the work.

It is true that standard dictionaries are often of little value in technical subjects and frequently, when they give the word, they fail to give a satisfactory equivalent. It is clear, therefore, that a work of this nature is eminently desirable to assist those engaged in the subjects treated. The necessity is all the greater because of the increasing amount of research being carried out in all countries in agriculture and its allied pursuits.

Dictionaries are the most difficult of all books to review. The test of their value lies not in a cursory glance through their pages but in their constant use. The value of this publication, therefore, will be more apparent after the lapse of some time than it is at present. Nevertheless, one can state quite definitely that the book is likely to be of considerable value to all agriculturists, horticulturists and apiculturists who consult foreign works: the names of those who have collaborated in the compilation are sufficient to warrant that.

Corrections and additions will doubtless require to be made for succeeding editions. This, however, is one of the few types of book to the perfection of which all can contribute by submitting helpful suggestions, as proposed by the Editor of the work.

*The Use of Fertilisers.* A. S. Barker. London, Oxford University Press, 7s. 6d.

Progress in agricultural science has advanced so rapidly in recent years that textbooks quickly get out of date. Particularly is this the case in regard to textbooks on soils and manures. On the one hand scientists are gaining more insight into the manurial requirements of crops on particular soils; on the other, chemical manufacturers are not now content merely to turn out a few standard fertilisers like superphosphate; they are turning out large numbers of new manures, many of them highly concentrated.

This textbook is designed, therefore, to provide up-to-date information about all matters relating to the manurial requirements of soils, the nature of the different fertilisers, and the manurial requirements of the different agricultural and horticultural crops. Mr Barker is to be congratulated on his book, which is well written, comprehensive in scope, correct in detail and thoroughly up to date.

One of the features of the work is the prominence given to the economics of manuring. Excellent as farmyard manure is, its economic use in these times may often be called in question because of the high labour and other costs required both in its production and in its application. Mr Barker gives some sound advice on this subject and suggests ways and means whereby the humus and fertilising constituents of the soil may be maintained without using this manure. Another aspect of the question of manuring which receives a considerable amount of attention in this book, is the effect of the different manures on the different crops. No longer does the British farmer confine his attention to the growing of the time-honoured grain and root crops; he is always on the outlook for new crops, such as kale and sugar beet or crops which formerly belonged to the market garden.

To the farmer, manure seller and agricultural student this book will be extremely helpful. Not only is it a mine of useful information, but it also gives a stimulus to deep and logical thought and should be particularly valuable as an aid to formulating a policy which will meet the times.

## Notes from Agricultural Colleges

### *Craibstone*

*Oats*, 1934.—It is not often that the soil is in good sowing condition in February, but this was the case in 1934, and the opportunity was taken to sow part of a field with Star oats on 21st February. Another part alongside was sown on 28th March, just when the former part was brairding. The soil in this field was comparatively good, so that it was not so liable to suffer during a dry spell. The February-sown part looked best for a considerable time, but the long dry spell in May and June appeared to affect it somewhat, whereas the rain that fell in July appeared to help the March-sown part more. Thus when the February-sown part was cut on 16th August it looked much less bulky. As the March-sown part ripened, however, it lost, to some extent, its bulky appearance, and at cutting time a fortnight later had much the same appearance that the February-sown part had when it was cut. The results show the fallacy of judging two crops when they are at different stages of growth.

*Star Oats*

| | Per acre | |
|---|---|---|
| | Grain cwt. | Straw cwt. |
| Sown 23rd February . . . . | 34·1 | 42·5 |
| ,, 28th March . . . . | 33·1 | 42·4 |

As a drill machine (4½ inches between the rows) was available, the opportunity was taken to sow part of a field with it and another part alongside with an ordinary broadcast machine. The same seeding (2¼ cwt. per acre) was used in each case. When the crop had brairded, the drilled part looked slightly better, but afterwards there was little apparent difference between them, and when threshed the yields were practically the same.

| | Per acre | |
|---|---|---|
| | Grain cwt. | Straw cwt. |
| Sown with drill . . . . | 33·7 | 40·3 |
| ,, broadcast . . . . | 34·1 | 42·5 |

It was thought after the dry season of 1933 that there would not be the same need to treat oats with a mercuric compound for leaf stripe. There were reports of a good many cases in the country where little or no advantage had accrued from this treatment. Our experience this year may give some guidance as to the reason for this, and as to the circumstances that may make the treatment less necessary.

In our trials, when sown on land recently ploughed and therefore comparatively dry, which never became wet but remained just nicely moist, the seed brairded quickly and neither the straw nor the thick-skinned types of oats showed any benefit from the treatment at any period. One cannot, of course, depend on getting such ideal conditions for brairding every year, and it would be well to take the precaution of treating the seed beforehand.

In another trial seven varieties of oats were sown after oats in a field that had been ploughed some time previously, and had therefore had time to become somewhat consolidated, and was consequently inclined to be damp and colder. In every case the plants from the treated seed were both more numerous and more vigorous than in the case of the untreated. The following yields were obtained :

|  |  | Treated with Ceresan |  | Untreated |  |
|---|---|---|---|---|---|
|  | Order of Maturity | Grain cwt. | Straw cwt. | Grain cwt. | Straw cwt. |
| Eagle . . . | 4 | 24·9 | 31·8 | 26·4 | 33·3 |
| Early Miller . . | 2 | 18·4 | 27·3 | 18·1 | 24·3 |
| Elder . . . | 7 | 16·2 | 28·9 | 18·0 | 31·2 |
| Glasnevin Success . | 3 | 21·8 | 28·9 | 19·5 | 28·9 |
| Star . . . | 5 | 24·4 | 39·0 | 18·4 | 30·6 |
| Victory . . . | 6 | 21·1 | 31·2 | 18·0 | 29·2 |
| Yielder . . . | 1 | 18·0 | 32·8 | 16·2 | 29·1 |
| Average . . |  | 20·7 | 31·4 | 19·2 | 29·5 |

Star showed the greatest increase. Before the introduction of the mercuric treatment this variety gave very erratic and often poor results, evidently owing to its being badly affected with leaf stripe.

Another trial was carried out by treating Star seed (1) at the middle of January, and (2) in March just before sowing time, at the rates of 1 and 2 oz. per bushel. While all the treated seed showed a distinct improvement over the untreated, that treated with 1 oz. in January looked more vigorous than that treated with 2 oz., whereas the opposite effect was noticed in the case of the results from the treatment in March.

The following average yields were obtained :

|  | Per acre |  |
|---|---|---|
|  | Grain cwt. | Straw cwt. |
| Treated in January—1 oz. . | 31·9 | 37·2 |
| ,, ,, January—2 ,, . | 30·0 | 35·7 |
| ,, ,, March —2 ,, . | 31·5 | 38·8 |
| ,, ,, March —1 ,, . | 29·5 | 36·8 |
| Untreated . . . . | 27·5 | 31·1 |

In the trial of standing power there was little lodging after rain, but the following varieties were broken down by wind—Marvellous, Eagle, Victory, and two Irish varieties, Glasnevin Success and Stormont Arrow, while Early Miller was slightly broken down. Elder, Yielder, Pure Line, Castleton and R.30 were not broken down at all.

In another field, where there was a good crop all over, Yielder, Pure Line, Early Miller and Elder were all standing after heavy rain at the beginning of August. Star was standing where sown thinly but slightly laid where sown thickly ; Victory was badly laid where sown thickly (3 cwt. per acre), but only leaning where sown thinly (1½ cwt.), while Castleton was badly down.

The following yields were obtained in this trial :

| | Maturity | Grain cwt. | Straw cwt. | Standing Power |
|---|---|---|---|---|
| Yielder . . . | 1 | 27·7 | 36·2 | 1 |
| Early Miller . . | 2 | 26·9 | 40·0 | 1 |
| Pure Line . . | 3 | 20·5 | 37·1 | 1 |
| Castleton . . | 4 | 18·1 | 47·7 | 7 |
| Star . . . | 5 | 33·1 | 42·4 | 5 |
| Victory . . . | 6 | 27·3 | 43·3 | 6 |
| Elder . . . | 7 | 28·9 | 33·2 | 1 |

The yields of Elder and Early Miller in this trial and those shown in Table I are interesting ; they indicate clearly that these varieties are not suited to poor conditions but give quite a good yield under better conditions.

In some dry seasons nitrogenous manures have little or no effect in increasing the yield. This year, however, dressings showed very distinctly and gave large increases. This was possibly due to the heavy rain that fell at the beginning of July. The following result was obtained in a field after potatoes, where 3 cwt. superphosphate and 1 cwt. potash salt were applied at seeding time and the nitrogenous manures when the crop brairded.

| | Grain cwt. | Straw cwt. |
|---|---|---|
| No nitrogen . . . . . . | 21·5 | 27·2 |
| 2¼ cwt. nitro chalk . . . . | 29·5 | 44·7 |
| 2¼ ,, nitrate of soda. . . . | 29·3 | 45·8 |
| 1½ ,, sulphate of ammonia . . | 30·5 | 45·0 |

There was a fair amount of " skelloch " on part of a field and the opportunity was taken to compare different strengths of sulphuric acid with a 5 per cent solution of copper sulphate, both being applied with a knapsack sprayer. The result from the 5 per cent solution of sulphuric acid was similar to that with copper sulphate, but a 7 per cent solution was fully better. The sulphuric acid was much quicker in its action. Neither kainit nor calcium cyanamide, which were also tried, were as good as these. Both were applied on a dewy morning.

*Turnips*, 1934.—The year 1934 was possibly one of the worst years for turnips in this part of the country. In the first place, many crops brairded very poorly and had to be re-sown, in some cases several times. This was due mainly to frost at night and to an attack by the turnip flea beetle. Another contributing factor, however, and one that seems to be insufficiently appreciated, was the germination of the seed. Nowadays, most people pay particular attention to the variety and the source of their seed, and rightly so, but many forget about the germination. In most seasons this is invariably high, but in 1934 many samples were very low. These appeared to be English-saved, as most home-saved seed was high.

Of 82 samples tested, 42 had both a low germinating energy and a low total germination, while the other 40 samples had both a high germinating energy and a high total germination. Germinating energy is a measure of the rate of germination in a germinator and represents the number that germinate in three days. The averages were as follows :

| | Germination | |
|---|---|---|
| Average of | Energy In 3 days | Total In 10 days |
| 42 samples . . | 68 per cent | 80 per cent |
| 40 ,, . . | 88 ,, | 93 ,, |

The seed of all varieties was sown on the same day. All the low germinating samples brairded slowly and poorly, and the plants were weak and in many cases had to be re-sown, while all the high germinating samples brairded much more quickly and vigorously. The average yields obtained from each class were as follows :

| | per acre Tons | Cwt. |
|---|---|---|
| Low germination . . . . | 11 | 4 |
| High ,, . . . . | 20 | 6 |

Another interesting feature in this trial was that many of the low germinating samples were badly affected with finger-and-toe, whereas the high germinating samples, even of the same varieties, were much less affected. Evidently the more vigorous plants were better able to withstand the disease.

In ordinary seasons yellow turnips usually produce a heavier crop than swedes, but in 1934 swedes were almost invariably better than yellows, average crops under the same conditions being—yellows, 14-15 tons, swedes, 20-24 tons, while mangolds, which are supposed not to be suited to our northern climate, produced a crop of over 30 tons per acre.

The following result was obtained when swedes were sown at different dates, commencing on 1st May, the seed used being of high germination.

| | Tons | Cwt. |
|---|---|---|
| May 1st . . . | 23 | 8 |
| „ 8th . . . | 18 | 12 |
| „ 15th . . . | 21 | 13 |
| „ 22nd . . . | 17 | 8 |
| „ 29th . . . | 13 | 3 |
| June 5th . . . | 11 | 0 |

The poor yield obtained from the seed sown on 8th May is explained by the occurrence of cold weather at the time of brairding.

## New Developments in the Heating of Glass-Houses

Movements toward cheaper and better methods of heating glass-houses have proceeded apace in Scotland within the past few seasons. Many decades ago the low-pressure hot-water boiler was introduced in place of the fires in hollow brick walls — a crude and yet wonderfully satisfactory method which was used in many large private gardens in the early part of the last century. A number of these hollow or tunnelled walls still exist and their structure is of great interest, but to-day the price of coal prohibits their use.

The low-pressure boiler, with its pipes spreading the heat through ranges of glass, is now in its turn considered by many glass-house owners to be unduly expensive.

About 300 tons of anthracite coal, costing in Scotland about 30s. per ton, are required to heat an acre of glass during a season, the total expenditure being thus £450 per annum. Many growers have therefore discarded their numerous small low-pressure boilers and substituted large steam-raising boilers using cruder and cheaper fuel. In some cases Cornish boilers capable of heating two-thirds of an acre have been installed in place of three or four large low-pressure boilers. The steam generated in these boilers is injected through nozzles into the existing pipes and the water therein heated and circulated by gravity as previously. Valve-cocks are placed in circuit with the nozzles to control the heat. Surplus water arising from the condensation of the steam is drawn off at the highest level, collected in tanks, and reinjected into the boiler. Again, a Lancashire boiler with double furnace, working on the same principle, can heat nearly two acres of glass. With boilers of these types the tonnage of coal used in a season is about double that required for low-pressure boilers, but the cost is less than half per ton, the price varying according to proximity to the pits from 6s. 6d. to 14s. 6d. per ton. In some cases forced-draught appliances, operated through the use of the steam generated, have been installed; these induce quicker heating and make it possible to use fuel of a still lower grade. While more attention to the fires is necessary with these methods, they enable a much more even temperature to be maintained. The saving in cost of fuel is estimated at from £70 to £150 per acre per annum. As most large areas of glass are annually sterilised by steam, the cost of a boiler for this purpose is a further saving.

Another device for enabling cheap coal to be used is the fitting of electrically-operated automatic stokers, combined with forced draught, to the existing low-pressure boilers. This arrangement reduces, instead of increasing, the need for attention to firing, large hoppers being fitted which are filled twice daily. Another advantage is that of thermostatic control. As yet, however, many owners of glass-houses have not access to an electric supply. The cost of heating an acre of glass by this method is estimated at about £240 per annum. Against the saving thus effected must be placed the cost of plant; this might, however, be reduced if plant were ordered collectively.

Experiments with electrical heating have been carried out by two methods, the element being introduced either into the water circuit or into the soil, but at the present price per unit this method is too expensive.

The use of crude oil burners, although satisfactory from the cultural point of view, is also too costly, as is that of gas for boiler heating, which was tried recently on a large area of glass in Eastern Scotland with gas at a relatively low price. Free fuel is enjoyed by one glass-house owner in Scotland in the shape of natural gas issuing near at hand, which he has laid on to his furnaces!

## Milk Act, 1934 (Section 9)
## Tuberculosis (Attested Herds) Scheme (Scotland)

In accordance with arrangements made by the Secretary of State for Scotland, and approved by the Treasury, for the purposes of Section 9 of the Milk Act, 1934, the Department of Agriculture for Scotland invite applications from owners of herds of cattle for the official certification of herds that are free from tuberculosis.

Applications can be accepted only from herd owners—

(i) Who are producers registered under a Milk Marketing Scheme in force in Scotland.

(ii) Whose management of their herds (including the conditions in which they are kept) is considered satisfactory by the Department and

(iii) (*a*) who hold licences for selling milk as Certified Milk or as Grade A (T.T.) Milk in terms of the Milk (Special Designations) Order (Scotland), 1930, provided that at the last two tuberculin tests made in terms of the order no animal reacted to the test *or* (*b*) who have taken steps to eradicate tuberculosis from their herds and whose herds have had no reactors in the last two tuberculin tests applied to them. The last such test must have been made within twelve months of the date of the owner's application and the previous test not less than six months nor more than twelve months before the last test. The application in this case must be accompanied by a certificate or certificates to this effect issued by the veterinary surgeon or surgeons who carried out the tests on behalf of the owner.

If the owner satisfies the Department as to the management of the herd and the conditions in which it is kept and undertakes to comply with certain rules, the Department will carry out an official tuberculin test (the double intradermal) of all animals in the herd, free of charge, and if no reactors are found will issue certificates of attestation (valid for one year) that the herd has been found to contain no reactors. Such herds will be known as Attested Herds.

Owners of herds will find it to their advantage to have their herds tested and certified. In the first place, official certification will secure publicity for tubercle-free herds in that certified herds will be advertised in an Official Register of herds found to contain no reactors, which will be published from time to time by the Department. In the second place, it will procure a bonus not exceeding 1d. per gallon for all Certified and Grade A (T.T.) milk that is sold from attested herds through Milk Marketing Boards in Scotland at a lower price than that prescribed by the Boards or ruling for Grade A (T.T.) milk.

Full particulars of the scheme and forms of application may be obtained on application to the Secretary, Department of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh 2.

The scheme came into operation on 1st February, 1935.

## International Congress for Scientific Management

THE Sixth International Congress for Scientific Management will be held in London from 15th to 20th July 1935. Its activities will naturally be largely concerned with manufacturing industry. In view, however, of the increasing attention being given to the principles of management in agriculture, a special section of the Congress will be devoted to this subject. An agricultural Committee has been engaged for more than a year in making the necessary arrangements which include the publication of articles on Management in the agricultural press. This issue of the *Journal* contains articles on the Management of Labour, of Poultry, of Rotation Grass, and of Hill Pasture, prepared in accordance with the Committee's scheme, and others will, it is hoped, be included in the issue for July.

Further information regarding the Agricultural Section of the Congress may be obtained on application to the Secretary, 21 Tothill St., London, S.W.1.

## Agricultural Conditions

THROUGHOUT December and the first three weeks of January weather conditions were open and mild, with practically no frost and an absence of snow. The rainfall in December was very heavy ; serious flooding was reported in South-East Perth, while in Berwick four inches of rain fell during the month. Conditions were unfavourable for threshing and difficulty was experienced in supplying foodstuffs in dry condition to live stock. The comparatively slight frosts in January were of short duration and the snowstorms towards the end of the month were not severe ; as a rule the snow lay only on the higher hills. The weather was more broken in the west and north than elsewhere; high winds were frequent and in places farm work was retarded by the wintry conditions and sodden land. By the end of January, however, farm work generally had made excellent progress, although in places the land was too wet to allow the carting of dung to the fields. During the first half of February the weather was mostly mild and open, but the latter part of the month was broken, with high winds and heavy rainfall in parts, particularly in the south-west and extreme west. Flooding occurred in Stirling and South-East Lanark. Keen frosts were experienced during the last week of February and snow fell in most districts. The preparation of the land for spring sowing made good progress but little sowing was carried out, owing to the wet condition of the soil. In North-East Fife, the Lothians and Peebles some oats were put into the ground, and in Wigtown the planting of early potatoes was begun.

In most districts the sowing of wheat was completed before the end of December. The crop benefited greatly from the mild and open winter and at the end of the year plants looked exceptionally strong and healthy. With favourable conditions prevailing throughout the most of January and February steady progress was maintained, and at the beginning of March the crop had a most promising appearance. In certain "dryfield" areas in Stirling some flourishing brairds almost disappeared during January and further sowings took place ; in parts of Kincardine, on the other hand, plants were too thick on the ground. The frosts at the end of February checked growth on some farms, and in North Ayr and on the lighter soils in Roxburgh the crop was rather backward. Estimates taken at the end of January indicate that there will be a further increase in the area under the crop this year ; in Berwick wheat has been sown in districts where it has not been seen for more than sixty years.

In the principal wheat-growing districts the increases in the acreage this year will vary probably by from 5 to 15 per cent, but in East Perth wheat has not been sown to such an extent as last year on unsuitable land and the area is likely to be reduced by about 5 per cent. The favourable weather conditions during the autumn and winter induced many farmers to push forward the sowing of wheat, with the result that in several districts spring sowings have been less extensive than usual. In a few eastern districts rather more spring sowings were undertaken than in previous years, while in Roxburgh, although the acreage of winter-sown wheat showed an increase of about 10 per cent, spring sowings also were considerably above the normal.

Reports on the condition of last season's potato crop were somewhat varied, but, on the whole, tubers were fairly sound and healthy when taken from the pits. Where the crop was secured under dry conditions potatoes generally kept well, but where pitted in wet condition the quality was less satisfactory. Sprouting was more prevalent than usual and was more general in the eastern half of the country than in the west. In the Lothians the keeping quality of tubers was not good, and in North-East Fife, where there was much disease, the difficulty in dressing increased with the advance of the season. In the south-east losses occurred through lateness in lifting the crop, some damage being caused by frost before lifting. In North-East Angus potatoes came out of the pits in good dry condition, but in the south-western half of the county there was a good deal of waste. Sprouting was widespread in Perth ; in South-East Perth white varieties were badly diseased and considerable quantities not worth the expense of dressing were used for feeding stock.

With the comparatively mild winter and continued freshness of grass sheep stocks made satisfactory progress and ewes generally approached lambing in good bloom. In some parts of the country, however, excessively wet weather in December adversely affected flocks. In Wigtown the flooded condition of field-drains caused much anxiety to shepherds, and in that county and in Dumbarton temporary blindness occurred in hill sheep. In North-East Angus a few early lambs were dropped by Half-bred ewes during December. Lambing began during January in a few eastern districts and, while it was not general during February, it was well begun among early flocks. In some parts flocks lost condition somewhat owing to the wet and cold weather during that month, but prospects for lambing were quite satisfactory. In Berwick the crop of early lambs was above the normal and in some flocks the number of twins was exceptionally high ; in Roxburgh and Selkirk, on the other hand, there was a slight shortage of twins. In North-East Aberdeen casualties were above the average. On the whole, results were satisfactory and, apart from the few days of severe weather at the end of February, early lambs had a good start and throve well.

On many farms the lifting and storing of roots was delayed, partly on account of rain and wet soil and partly to allow further growth under the favourable weather conditions. The practice of leaving turnips and swedes in the drills generally proved successful, swedes especially improving appreciably in bulk and condition ; in several districts, although bulbs were below the average in size, the crop far exceeded earlier expectations. Yellow turnips were, however, most disappointing ; disease was widespread and many farmers did not risk storing owing to the doubtful keeping quality. With continued mild weather grass remained remarkably fresh and green and this, together with the rather more extensive use of sugar-beet pulp, helped greatly to mitigate the shortage of turnips. At the end of February reports of the supplies of fodder on hand varied from county to county and on many farms there was a scarcity of hay and straw.

Although farm work was well in hand at the time of the Martinmas hirings, reports received by the Department indicated that the number of workers who failed to fix engagements at the hirings was smaller than it was a year ago in practically all districts. This was accounted for in some places by the movement of agricultural workers to the towns. Apart from a scarcity of experienced farm hands in Ross and a shortage of dairy workers in Renfrew, the supply of workers at the end of February was ample for all requirements.

## SCIENCE AND PRACTICE

*The following extracts and summaries are supplied by members of the staffs of Scottish agricultural colleges and scientific institutions or are taken from recent bulletins of the International Institute of Agriculture. Full references to the original publications may be obtained on application to the Secretary, Department of Agriculture, York Buildings, Edinburgh.*

### CROPS AND SEEDS

**Effect of Various Smut Treatments on Yield of Winter Wheat.** *A. F. Bracken. Jour. Amer. Soc. Agron., Vol. 26, No. 9.*—The effects of treating wheat seeds with formalin, copper sulphate and copper carbonate on yields of fall wheat, as compared with the yields from untreated seeds, were ascertained over a period of ten years under dry-land conditions in Utah, U.S.A. It was found that untreated seed gave an average yield of 24·7 bushels ; copper carbonate, 24·8 bushels ; copper sulphate, 23·4 bushels ; and formalin-treated wheat, 21·8 bushels per acre. It will be noted that the average yields of wheat treated with copper carbonate and of wheat receiving no treatment for control of smut, are almost identical. No smutted heads were observed in the untreated wheat. It was stated, however, that had smut occurred, the yields would have shown a reduction almost in proportion to the percentage of infection.

**Pasture Management : Good "Control" of Pastures is not necessarily good "Management."** *A. W. Hudson, Crop Experimentalist, Plant Research Station, Palmerston North, New Zealand. New Zealand Jour. of Agric., Vol. 48, No. 5.*—In an investigation carried out at the Marton Experimental Farm, 1929-32, cutting pasture at a "sheep-grazing" stage was compared with cutting at a "cattle-grazing" stage. The intervals between cutting ranged from five to seventy-four days when cut at the sheep-grazing stage and from twelve to ninety-nine days at the cattle-grazing stage. The less frequent cutting gave 10 per cent greater production of green herbage than did the more frequent cutting.

From the results obtained it was evident that the mere fact of keeping the pastures continually short is in itself limiting their capacity to produce. An appreciable increase in production of herbage can be achieved by rotational grazing, a system which, it is claimed, is practicable and productive of outstanding results. The lengths of the resting periods between grazings and the intensity of stocking should be governed by circumstances.

**Seed Yields of Pedigree and Commercial Grass Strains.** *Gwilym Evans, B.Sc. Welsh Jour. Agric., Vol.* 10.—An account is given of an experiment laid down to obtain comparisons with regard to seed yields between grass strains bred at the Welsh Plant Breeding Station and commercial strains.

Data given in the paper cover two harvest years for perennial and Italian ryegrass, and three harvest years for cocksfoot, timothy, meadow fescue and red fescue.

The following are some of the conclusions drawn from the results of the experiments:

It is possible to breed strains of grasses superior to ordinary strains in leaf production and still able to produce in the course of two or more harvest years an aggregate yield of seed as large as or even larger than that of the commercial types.

Commercial strains tend to produce heavier yields of seed than the bred strains in the first harvest year, while the latter show to better advantage in the second and third harvest years.

Applications of nitrogen in the spring increase the yield of seed significantly in all the strains of perennial ryegrass, Italian ryegrass, cocksfoot and timothy.

The superior leafiness of the bred strains is indicated by the relatively greater number of barren tillers.

Pedigree strains are more winter green than commercial strains.

**Report of the Technical Wheat Committee** (*Verslagen van de Technische Tarwe Commissie*). *Ir. R. H. Visser.* (*With an English summary.*) *Drukkerij Gebroeders, Hoitsema-Groningen,* 1934.—The task of this Committee was to undertake research on the suitability of home-grown Dutch wheat for bread making, and a number of problems relating to the technique of growing wheat and of manufacturing flour had to be investigated. The report describes the methods of testing and the influence of variety on baking quality.

Differences were found in the resistance to sprouting of several wheat varieties, red wheats appearing to be less liable to sprout. The percentage of moisture is of much importance in Dutch wheats, most of which are too moist. Red wheat was always a little moister than the white varieties.

A large percentage of gluten of good quality is most important, the gluten being the principle structural element of the dough.

Emma, Jacob Cats, and Juliana were the best winter wheats, but the best baking-value was shown by the spring wheat variety Svalöfs Extra Kolben II. In general the gluten in Dutch wheat is weak and poor in elasticity and the better varieties contain gluten that is somewhat more elastic. The quality of the gluten seems to be of more importance than the quantity in the varieties grown in the Netherlands.

## SOILS

**Crown Rot of Beet a Boron Deficiency.** *Hughes and Murphy. Nature,* 135, 395, 1935. —It has been shown by E. Brandenberg that crown rot of sugar beet and mangel is caused by boron deficiency and not by a fungus as supposed. Further experimental proof is given and it is found that applications of 12-20 lb. of borax per acre increases the yield of beet considerably in affected areas. The sugar content is also increased. Addition of borax in the unaffected areas showed no effect, good or otherwise.

**A Response of Chlorotic Corn Plants to the Application of Zinc Sulphate to the Soil.**—*Barnette and Warner. Soil Science,* 39, 2, 1935.—A chlorosis of the corn plant known as " white bud " has been found to yield to a dressing of 20 pounds per acre pure zinc sulphate. Stable manure and leaf mould have also been found to produce healthy corn plants in an affected soil, and a considerable improvement has been found to follow the application of chicken manure and alkaline peat. Spectroscopic tests showed the presence of zinc in the ashes of these organic materials.

**The Available Phosphorus and Potassium Contents of Surface Soils and Subsoils as shown by the Neubauer Method and by Chemical Tests.** *Thornton. Jour. Amer. Soc. Agron.,* 27, 1, 1935.—The data presented indicate that for subsoils of the humid regions of the United States of America, phosphorus deficiency is an important factor in the unproductivity so often observed.

**Competition amongst Hemp, Flax, and Oat Plants grown simultaneously in Soils of varying Fertility.** *Dobrunow. Zeit. Pf. Dung. u. Bk.,* 13, 12, 1934.—A description is given of a series of experiments which have been conducted in the Ukraine and in which hemp, flax and oats have been grown separately and together in pots. The results indicate that hemp requires a richer soil than either flax or oats.

**The Influence of Potash Manuring on the Chemical Composition of Crops.** *Jacob. Zeit Pf. Dung. u. Bodenk.*, 37, 1/2, 1, 1935.—Typical results are given for the chemical composition of various crops from field experiment plots at Berlin-Lichterfelde. The potash content of most plants is increased appreciably by increasing additions of potash manures. No relationship appears to exist between potash manuring and uptake of phosphoric acid by the plants. The effects of potash dressings on the nitrogen and on the lime contents of various plants are also discussed. Generally a slight reduction in the contents of the plants in these substances follows an increase in the dressing of potash.

## DAIRYING

**Udder Infections and Sore Throat Illness.** *Davis* (1934). *Jour. Bact.*, xxix., 42.—The author notes that outbreaks of sore throat in the human subject, traced to milk at times, have followed teat injuries. By placing on the teats of a healthy cow organisms of the type that cause sore throat illness (*hæmolytic streptococci*), he was able to induce mastitis in a short time. The inference would appear to be that mastitis-producing organisms can reach the udder through the milk ducts of the teats.

**Emery Flavour in Milk.** *Kende* (1934). *Österr Milchw. Zeitung*, xli., 277.—A peculiar and disagreeable flavour in milk, known as the " emery taste," has been recognised both in America and on the Continent. The author states that this emery flavour is caused by an oxidation of the milk fat, and that heavy metals, especially copper, derived presumably from the utensils, play an important part in this oxidative process. The defect is similar to the tallowy flavour which is frequently encountered in cream, butter and dry milk. Certain natural protective substances (of plant and bacterial origin), if present in the milk, exert a controlling effect on the development of the emery flavour. The feeding of good meadow hay and concentrates poor in readily oxidisable fat and the avoidance of contamination by iron or copper from the utensils diminish the possibility of an emery flavour.

## ANIMAL BREEDING

### *Cattle*

**Susceptibility to Acute Mastitis in Cattle.** *W. T. White and H. L. Ibsen.* 1934. *Jour. Hered.*, *25*, 489-490.—The Alaska Agricultural Experiment Station has for long been crossing the Holstein with the Galloway in order to produce a hardy cow. Calves of the fourth and fifth generation are now being born. During the course of this experiment three cases of acute mastitis occurred among related animals. This suggested the possibility that susceptibility to this disease is inherited. Except for these three cases no example of mastitis of such marked virulence has been found in any of the several hundred other cows bred by the Alaska Station. It has been estimated that about eight cows per thousand per year have the acute, or clinical, type of mastitis. It has also been observed that this acute type rarely spreads through a herd. It occurs in isolated instances and, although the cow has been in the milking line previous to infection, adjoining cows rarely become infected. The sub-clinical (sub-acute, chronic, latent, etc.) form of mastitis is much more prevalent and may vary in a herd from 20 to 90 per cent of the individuals.

This paper includes a discussion of the problem, and the material as presented appears to agree with the assumption of the authors that predisposition to acute mastitis is inherited; it would appear legitimate to assume that one or more dominant genes are responsible for that susceptibility.

There is the possibility that susceptibility to the milder forms of mastitis is also inherited. Hitherto a genetic basis has not been considered to be a principal cause of mastitis in cattle. This paper clearly shows the need for investigators to be awake upon this point. Mastitis is one of the most objectionable diseases which at present beset dairy herds. If a susceptibility to the disease is definitely proved, then it will mean that the trouble can be better eradicated by breeding methods than by attempting to control infection.

**The Genetics of the Hereford Pattern.** *H. L. Ibsen and A. D. Weber.* 1933. *Proc. Amer. Soc. Anim. Prod.*, 291-294.—Evidence obtained recently proves fairly conclusively that the whole pattern of Hereford cattle, by which is meant the pigmented as well as the white part of the coat, is due to one gene which is allelomorphic to self-colour and to recessive white spotting. It has been generally assumed that this gene is incompletely dominant to self-colour, and unpublished data obtained by the present authors show that this gene is completely dominant to the recessive factor for the usual white spotting found in cattle. Since the Hereford factor is incompletely dominant to self-colour, but completely dominant to the recessive spotting, the authors suggest that the simplest and surest method for producing a homozygous strain of white-faced Herefords from a mixed population would be to mate white faces, whether homozygous or heterozygous, to self-coloured animals and retain for further breeding those white faces that had a very small amount of white. The latter, when inbred, should produce on the average one fourth good homozygous white faces, one half white faces with too little white to be considerable and therefore obviously heterozygous, and one fourth self-coloured.

The authors point out that this actually was the method followed by the founders of the Hereford breed in England. It seems to be generally agreed that the original cattle of Herefordshire were self-reds with black extremities. It appears that there was little, if any, white spotting present in the foundation stock of the Hereford breed. For this reason it became a simple matter to produce true breeding white faces.

When the Hereford Herd Book was first published in the year 1845, four different colour types were in existence and eligible for registration: " mottled face, dark grey, light grey, and white faced." The mottled face probably corresponded to what are now called " brockle-faced," and Dr Ibsen suggests that this was due to a dominant gene which causes large pigmented spots on the face and also extra pigment on the legs. Since it was dominant this gene could easily be eliminated by selection.

The paper contains other notes on the brindle character and the black hairs.

**Semi-Hairlessness in Cattle.** *W. A. Croft* and *W. L. Blizzard.* 1934. *Jour. Hered.*, *25*, 384-390.—Early in 1932 a herd of cattle in Oklahoma was brought to the attention of the writers owing to the birth of a number of semi-hairless calves. A pure-bred polled Hereford bull had been used in this herd of mixed cows for several years. The first semi-hairless calf was dropped in 1926. Out of 260 calves born since that time, 22 are semi-hairless. The feeding of potassium iodide had no effect. More recently another herd of polled Herefords has been reported, in which three normal-haired cows had produced semi-hairless calves, two semi-hairless heifers, and one semi-hairless bull; these were purchased for the Oklahoma Agricultural Experiment Station and various matings were made. The character appears to be transmitted in a recessive manner. It is not lethal, but the affected calves do not grow as well as, and are also wilder than, those with normal hair. Experimental matings substantiate this.

**Afrikander Cattle.** *H. Epstein.* 1933. *Jour. Hered.*, *24*, 448-462.—The general belief is that the red Afrikander cattle of South Africa descend in a direct line from one of the indigenous breeds of Africa. It is possible that Portuguese cattle were introduced and that the Afrikanders may have been modified by them or by red Devons, introduced by the Governor of the Cape during the years 1814-26. The present writer believes that these importations can have had little effect on the native breed, though it is possible that there may be in the Afrikander some blood of cattle from Friesland, imported between 1775 and 1785

In the present paper the writer discusses the origins of this breed and traces its history through its many vicissitudes of trek, rinderpest and war. He comes to the conclusion that the cattle of the Hottentots and the Red Afrikander belong to the Zebu group. He asserts that it is even probable that the original characteristics of the Zebu cattle are here preserved in a purer form than in the Zebus of Asia.

### *Sheep*

**Reproduction in the Sheep.** *R. T. Clark.* 1934. *Anat. Rec.*, *60*, 125-151.—The object of this investigation was to attempt to determine the fundamental factors influencing the phenomenon of twinning in sheep. The paper includes an interesting review of the whole subject, discussing prolificacy both from the genetical and environmental standpoints.

The experiment, conducted by Dr Clark, is based on 40 grade western ewes, 2½ years old and over. These were divided into two equal groups, group I being subjected to a high plane of nutrition, whereas Group II was fed a ration designed to maintain them as close as possible to their initial rate. Each ewe was mated twice and the ewes were thereafter slaughtered. Immediately after slaughtering the reproductive organs were examined. A second experiment on the same plan consisted of 40 pure-bred Shropshire ewes from the University of Minnesota, divided into two similar groups.

In the first experiment the flushed group produced more eggs than did the unflushed group of ewes. In the second experiment, where the Shropshire ewes were in a relatively high condition at the beginning, the flushed group did not produce as many eggs as the unflushed. It can thus be inferred that the condition of the ewes at the beginning of the experiment was an important factor in determining the response to the imposed environmental conditions. For this reason it is unwise to apply intensive flushing to a flock in a high condition. Dr Clark therefore comes to the conclusion that the practice of flushing will lead to a higher ovulation rate, provided the ewes are not in a high condition initially.

He also found that gain in weight of itself is not necessarily indicative of a higher ovulation rate. Furthermore, flushing appears to have no likely effect in bringing ewes into " heat " faster, provided their oestrous cycles have already been established.

With the same material Dr Clark has made a study on the development of the egg in the ewe. The flocks were watched carefully during the entire period of the investigation

In order to ensure a high percentage of successful matings and to have an accurately timed series, the approximate time of ovulation was ascertained by destroying a number of ewes at different intervals during the period of " heat." Ovulation was found to occur rather late in the " heat " period. Hence, matings were made at the close of the second day after the ewe first showed signs of oestrous. The ovulation averages (number of eggs produced) were pretty much the same as the lambing percentage of the Shropshire breed.

The greater part of the paper is technical in that it discusses the development of the egg. The author confirms that the ova do not migrate from one uterine horn to another in sheep, as is the case in pigs. In this investigation the period of the oestrous cycle varied from 13 to 18 days, with an average of 16·4. The actual length of the period of " heat " ranged from less than 24 hours up to 72 hours, with the majority falling between 36 and 48 hours. No difference was observed between the groups with respect to time of coming in heat.

With regard to the rate of the development of the egg, Dr Clark shows that the first cell division takes place between 38 and 39 hours after service. The second and third cell divisions follow the initial one very quickly, the four- and eight-cell stages being found at 42 hours after service. Sixteen-cell stages were recovered at 65 hours after service and the fertilised eggs passed into the uterus between 77 and 96 hours after service. The 32-cell stage is reached about 96 hours after service.

The size of the unsegmented egg is larger than that of the cow, pig or rabbit. There is, however, a remarkable degree of similarity amongst the eggs of these animals, which becomes all the more impressive when the relative body sizes of the various species are considered.

**Horn Inheritance in Sheep.** *B. L. Warwick and Others.* 1933. *Proc. Amer. Soc. Anim. Prod.*, 287-289.—In the Rambouillet and Merino breeds in the United States the rams have large horns, while the ewes, though lacking typical horns, always have protrusions of the skull or knobs at the poll. These knobs may or may not break through the skin to form scurs.

The data provided in this paper would indicate that these knobs in the ewes are the equivalent to horns in rams.

For some years flocks of polled Rambouillets have been bred and many ranchmen in the south-west of the United States prefer polled rams. Five of these rams with good polled heads were bred to horned stock. Four of these produced both polled and horned offspring. The other one produced males without any horns, although a few of them had scurs. The females were polled. The writers analyse the matings and come to the conclusion that it is right to consider the knobs of the ewes as equivalent to horns, and that the polled condition is transmitted as a simple dominant, the horned condition being recessive. Thus, in the Rambouillet and Merino sheep, horn inheritance can be considered to behave in the same way as in cattle and in goats.

### *Pigs*

**Analysis of Growth and Carcase Measurements of Baconers.** *G. N. Murray.* 1934. *Onderstepoort Jour. Vet. Sci.*, *2*, 301-360.—The object of the work described in this paper was to study the growth of baconers from every standpoint, with a view to the provision of information for the time when bacon factories would start paying for pigs on a quality basis. An analysis was accordingly made of the growth and carcase measurements of some 500 baconers out of Large Black sows. These fell into two groups, the one sired by Large White boars and the other sired by Tamworth boars.

For 39 farrowings the average gestation period was 113 days. The average birth weight of 494 pigs born alive was 2·89 lb., the males being 2·99 and the females 2·78 lb. respectively. There was found to be a continuous decrease in the birth weights of both sexes as the sizes of the litter increased. There are useful figures on the rate of growth and these are discussed in relation to the other work which has been done.

With regard to the weight at four weeks as an indication of the weight at eight weeks, a positive correlation as high as 0·76 was found to exist.

The second part of the paper relates to the factory results, and is introduced by a Table showing the differences in the average and relative weights and measurements of the two crosses of pigs. For this purpose there were 156 Tamworth × Large Black crosses, and 295 Large White × Large Black crosses. These were taken to 194 lb. and 196 lb. live weight respectively. Their factory weight averaged 178 lb. for the group sired by the Tamworth and 180 lb. for the group sired by the Large White. Likewise there was little to choose between the groups as regard carcase weight or the weight of the cured side. The average daily gain also showed little variation, being 1·306 for the Tamworth and 1·31 for the Large White. Again, in carcase measurements, there was little to choose between the two lots. The back fat of the Tamworth group measured, at its thickest point, 2·03 inches, while the Large White group measured 2·19 inches. The Tamworth sired also the thickest bellies.

Although the average results of the two crosses do not show marked differences, there are large differences between the average results of the progeny of different boars of the same breed. There were found to be 24 per cent more females than males in the higher grade. The heaviest pigs made the quickest gains and had longer and deeper sides.

The correlation coefficient between weight and length and between weight and depth are respectively + 0·48 and + 0·5. Barrows are deeper than females at the shoulders, but the latter are deeper at the flank. The barrows are fatter and have better marbling than the gilts, but the latter have better bellies.

Depth of side increases with rate of gain, but it has hardly any effect on the length of side. Back fat increases with an increase in the rate of gain, the correlation being + 0·35. Females have thinner back fat than males, but fatten at a more rapid rate.

For baconers, the writer considers that the optimum gain per day is between 1·2 and 1·49 lb. Length cannot be significantly influenced by rate of gain. The actual depth of side appears to decrease slightly when length increases, whereas the relative depth increases markedly. The longer the side, the less is the back fat likely to be.

**Congenital Defects in the Mammae of Swine.** *J. E. Nordby.* 1934. *Jour. Hered.*, *25*, 498-502.—Any significant variation from the uniform spacing of nipples in pigs is most undesirable. It is not unusual to find too much space in front of the first pair of nipples and a crowd of teats towards the rear. In all probability the arrangement of teats is influenced by heritable factors. Likewise there are many variations in the shape of the individual teats. While some of these shapes do not particularly influence functional efficiency, others seriously affect the ability of the nipple to function normally. In a number of cases nipples that may appear inverted when the female pig is five or six months old develop later to the normal length. Total suppression of nipples in swine is common, and similar defects have been reported in cattle and the human.

The present paper describes various defects and deals more particularly with the inheritance of inverted nipples, which the author describes as resembling a pit or crater in the breast. These inverted nipples do not seem to be associated with a lack of gland development.

The defect has been observed for a number of years and was particularly noticeable in one line bred strain. From the data available, there can be no doubt that the defect is inherited and that the hereditary influence probably functions as an inhibitor to normal nipples. These hereditary inverted nipples cannot be put right by practical means of manipulation. In order to eliminate the defect, the authors recommend that no animals should be used for breeding that are possessed of inverted nipples or that are the progeny of such parents, or that are themselves the parents of affected offspring.

**Inbreeding Berkshire Swine.** *E. H. Hughes.* 1933. *Jour. Hered.*, *24*, 199-203.—Inbreeding experiments with swine have been taking place in various parts of the United States. In this paper Dr Hughes points out that, as a result of inbreeding at each of four places, there has been a loss of vigour in the inbred pigs. At two of these stations difficulty is being experienced in getting inbred boars to mate with their litter mate sisters.

In 1922, in the University of California, there were some closely related Berkshires which formed the foundation for an inbred herd, which has been continued till the present time, although at one period nearly half the animals reacted to the agglutination test for swine abortion.

In this experiment the average number of pigs farrowed in the inbred litters has been 9·78, which is greater than the average for the Berkshire herd. There has been a slight, but gradual, decrease in the number of pigs farrowed in the inbred litters since 1923. The type of the pigs in all the inbred litters has been similar, and there has been no noticeable colour change or structural abnormalities in any of the pigs.

Comparing the results obtained in California with those obtained at other American Experiment Stations, it would appear safe to deduce that these experiments are further proof that inbreeding can succeed only where the foundation stock is sound.

### *Poultry*

**Inbreeding Poultry.** 1934. *Bulletin No.* 83, *Ministry of Agriculture.*—This Bulletin covers the work done at the Poultry Research Station at Reaseheath. The object of the investigation was to determine whether it was advisable for the average poultry farmer, who was breeding for high egg production, to follow a policy of inbreeding. The results show that, however useful it may be for fanciers, the policy of inbreeding is not one to be adopted by the average commercial poultry breeder. The answer is clear and unequivocal.

Two systems of inbreeding were employed, one involving the mating of a selected cock with his own daughters; in the other method the cock was mated to his sisters and then to his daughters. At the same time outbred controls were kept going. So far as possible fresh blood brought into the flock consisted of good birds, such as any progressive commercial breeder would purchase.

The experiments cover three breeds, White Wyandotte, Rhode Island Red and White Leghorn; during the latter years of the experiment, however, the White Wyandotte was the only breed employed.

As regards the average annual production, that of the control progeny was greater than that of the inbred progeny for each of the breeds in almost every instance. The whole evidence points to the conclusion that the annual production of the progeny of unrelated sires and dams is greater than that of progeny from the same sires mated to their daughters.

There was considerable variation in the degree of infertility in different years and no conclusions can be drawn. The control stock had, on the whole, a better hatchability than any of the inbred stock. Likewise the percentage of chicks that were reared was higher for the controls than for inbreds. Other figures relate to age and weight at sexual maturity and mortality in laying houses. Complete tables are given of the various results, which are treated adequately from a statistical standpoint. The whole Bulletin is clearly written in a manner well within the understanding of practical breeders, to whom it can be thoroughly recommended.

**Flightless Fowls.** *R. L. Mayhew.* 1934. *Jour. Hered.*, 25, 409-410.—During 1931 a pullet was discovered in the flock of the Louisiana Experiment Station with an entire lack of flight feathers in both wings when she was eight months of age. The feathers moulted during the preceding month. The bird remained in this condition until her death at the age of two years and four months. A year later, almost all the flight feathers were observed to be lacking in both wings of a cockerel. Special matings were made which indicate that the condition is not inherited as a simple mendelian character. The condition does not seem to be pathological and the description is not identical with that of a similar case reported by Dr Warren.

### *General*

**The Attack on the Gene.** *T. S. Painter.* 1934. *Jour. Hered., 25,* 464-476. The chromosome is a small, rod-shaped body found in practically all living cells. It plays an important part in the transmission of hereditary characters. Previous work has shown that on the chromosome are located what are known as the genes. Every inherited character is governed by one or more pairs of these genes. The gene is thus the unit of hereditary mechanism. The genes are located in order along the length of the rod-shaped chromosome.

In the reproductive cells the chromosomes are squat and it is very difficult to examine them properly under a microscope. Dr Painter has discovered that in the cells of the salivary glands the chromosomes are very much elongated. They are stretched out and in the photographs assume the appearance of long tape worms. Because they are so elongated, it is possible to examine them far more closely than has been the case hitherto. This paper deals with the results of the first careful examination of such elongated chromosomes.

Dr Painter has found that the chromosome consists of an elongated, more or less cylindrical, rod made up of material which, when subjected to a stain, does not take on much colour. Running across each chromosome may be seen a great variety of " bands." Some of these bands are broad and take on a deep stain; others are narrow and may even be made up of only a series of dots. Dr Painter found that these different markings on the chromosomes were constant to a quite extraordinary degree, with the result that he was able to recognise the same element in the chromosomes of different individuals: he was thus able to follow a characteristic bit of chromosome as it moved about.

It is in the fruit fly called Drosophila that the greatest amount of work has been done in correlating external characters with genes located on the chromosome. This is particularly the case as regards the pair of chromosomes which control sex. The sex chromosome is called the X-chromosome. Dr Painter outlines three methods by which he has been able to study these chromosomes and connect their different parts with the various characteristics of the animal which are affected. The question to which he is seeking to find an answer is—" Where are the genes? Are they represented by the deeply staining material or by some other part of that region of the chromosome? "

So far as he has been able to show, the gene resides in that area of the chromosome covered by one, or part of one, band. There is no definite proof that they are part of any of the structures which have been seen in these bands. Since, however, the bands are obviously particulate and are complex in their structure, it would appear logical to suppose that the genes are to be found in these bands. Actually, whether these tiny bands are the genes themselves or only the bearers of the genes is a matter of relative unimportance. The important thing is that they have been unveiled, so that the searching finger of science may probe a little further into the secrets of life.

At the moment it is difficult to foretell the implication of these new discoveries. That they are of profound scientific importance there can be no doubt whatsoever. Whether they will be of practical value in stock and animal improvement remains to be seen, but no breeder can fail to be thrilled at the thought that the inmost secrets of the mechanism of heredity are now being rapidly revealed to the human eye.

## ANIMAL NUTRITION

**Feeding Hay Meal.** *Liebscher, W. Landeskultur,* 1934, *1,* 153-157.—Methods of preparation and feeding are described. Hay meal was not found to give better results than ordinary hay with horses and cattle. With fattening pigs hay meal, as 5 per cent of the total dry matter of the ration, gave increased gains, but the same effect could be got by feeding lucerne hay. Breeding sows are fed roughage chiefly for bulk and previous grinding is uneconomical. Poultry should not be given more than 10 per cent of clover meal. The favourable effect on egg quality can be more cheaply produced by feeding silage.

**Potato Tops must be used for Feeding.** *K. Richter. Die Kartoffel,* 1934, *14,* 114.—The tops should not be cut until they begin to wither, *i.e.* when most of the solanine has disappeared. They are best used as silage. The tops should be cut and packed preferably in impermeable silos with 1 per cent feeding sugar or 2 per cent molasses. Experiments with silage made in this way showed a digestibility of 58 per cent of the organic matter for ruminants. With a dry matter content of 18 per cent the starch value of potato top silage was 7·3 kg. per 100 kg. feed, and the digestible protein 1·3 per cent. The composition is therefore comparable to that of sugar beet leaves.

If the silage is of good quality, as much as 20 kg. per day may be fed to milk cows. If the quality is not so good, not more than 10 kg. should be fed. It may also be used for fattening cattle, calves and sheep.

Haymaking from potato tops involves more difficulties (since it must be done so late in the year) to avoid the loss of the protein rich leaves. Ensiling is to be preferred.

If the plants are heavily affected by fungi, there may be danger of serious digestive disturbances.

**The Feeding Value of Artificially Dried Young Grass** (3). *O. M. Camburn. Vermont Agric. Exp. Stat., Bull. No.* 368, *March* 1934, p. 10.—In a short-period feeding trial with ten dairy cows, soaked artificially dried grass was used to replace maize silage in the ration during the second month. The grass ration gave a slightly greater production of milk, fat, and solids not fat, but the cows lost weight. On the grass the cows required slightly less nutrients per unit of milk and slightly more per unit of fat.

**The Comparative Effectiveness in the Dairy Ration of Supplements of Phosphorus in the form of Orthophosphoric Acid, Monosodium, Disodium, Trisodium Phosphates, and Bone Meal.** *W. A. Turner, E. B. Meigs, E. A. Kane, L. A. Shinn and W. S. Hale. Jour. Agric. Res.,* 1934, *48,* 619-630.—The indicated phosphatic supplements were compared in two experiments on three cows over successive 3-week feeding periods following a 10-week period on a basal ration of alfalfa and grain. The balances of Ca and P were sometimes rendered more positive during the feeding of soluble orthophosphates and milk phosphorus was slightly increased, but the results are difficult to interpret. The authors consider that considerable quantities of Ca and P may be retained as tricalcium phosphate in the alimentary tract for several weeks, and that in experiments of short duration there is no way of differentiating such retention from a true positive tissue balance.

**Linseed Meal for Growing and Fattening Lambs.** *T. B. Keith and W. L. Henning. Pennsylvania State Coll. Sch. Agric. and Exp. Stat., Bull. No.* 307, *May* 1934, p. 12.—When linseed meal replaced 5, 10 and 20 per cent yellow maize in a ration of equal parts alfalfa hay and yellow maize, no differences in the rate of gain were observed, although the palatability of the ration was increased. It is claimed that linseed meal can only be fed economically in the ration when the cost is equal to or less than that of yellow maize.

**The Influence of Feed on the Merino Sheep.** *G. S. Maré and V. Bosman. Onderstepoort Jour. Vet. Sci. and Animal Indust.,* 1934, *3,* 199-210.—Five three-year-old Merino sheep were well fed for 18 months, five underfed for 18 months, five well fed for 9 months then underfed for 9 months, five underfed for 9 months and then well fed for 9 months. The ration consisted of lucerne hay, crushed yellow mealies, whole oats and fresh saltbush, with addition of salt and bonemeal. The underfed groups received the same foods as those well fed, but in less amount. It is shown that in addition to changes in body weight, different levels of nutrition have a profound effect on fleece weight and on fibre diameter. Thus underfeeding reduced scoured fleece weights by 31·8 per cent and reduced fibre diameter by 36 per cent. Subsequent good feeding restored the original fibre diameter.

**Nitrogen Metabolism of Growing Pigs Fed Dried Yeast; Soya Bean Meal and Earthnut Cake Meal.** *J. Schmidt, M. Freiin v. Schleinitz and E. Lagneau. Biedermanns Zentralbl.*

*B. Tierernährung*, 1934, *6*, 281-291.—The relative efficiency of the proteins of dried yeast, extracted soya meal and groundnut cake meal was measured in metabolism experiments with pigs at five stages of growth. Each group consisted of three pigs drawn from the same farm and in part from the same litters. Nitrogen retention was higher with the groundnut and yeast rations than with the ration containing ground soya beans. On the average of the five periods the daily nitrogen retention per head was 13·69 g. for the yeast ration, 13·22 g. for the groundnut ration, and 11·71 g. for the soya group. The times required to raise the live weight of the pig from about 50 kg. to about 150 kg. were 196, 207 and 252 days respectively. Up to 50 kg. live weight there was little difference between the three groups in this respect, the divergences being only small until a live weight of about 100 kg. was reached.

**Cottonseed Meal for Pigs.** *W. L. Robison. Ohio Agric. Exp. Stat., Bull. No.* 534, *May* 1934, p. 44.—Ten experiments on over 500 pigs are described in an attempt to discover the cause of the failure of pigs to thrive when fed rations containing high amounts of cottonseed meal.

Pigs were estimated to be from 5 to 7 times more susceptible to cottonseed meal injury than were rats. The addition of minerals or of minerals and ground alfalfa to a ration of yellow corn and cottonseed meal did not prevent the toxic effect. Rations containing cottonseed meal, even when high in vitamins A and D, were toxic.

Cottonseed meal made by a special process (not given) showed a low toxicity (mortality 6·6 per cent) compared with meal made by the usual process (mortality 53·3 per cent). Moistening and autoclaving cottonseed meal under 14 lb. pressure for one hour destroyed or reduced its toxicity. Pigs fed on autoclaved meal (20 per cent), yellow corn, alfalfa and minerals were not produced so economically as when linseed meal replaced the autoclaved cottonseed meal, probably on account of a reduction in the digestibility of the autoclaved meal.

Iron sulphate in solution (1·5 lb. iron sulphate in 2·5 gallons of water per 100 lb. cottonseed meal) appeared to reduce the toxicity of the cottonseed meal: dry iron sulphate did not.

In obtaining the above results, cottonseed meal was fed as the only protein concentrate at levels ranging from an average of 18 to 22 per cent of the total feed. No deaths occurred when tankage formed a part of the protein supplement, even when the cottonseed meal remained at the 20 per cent level. Excellent results were obtained with soya bean oil meal and cottonseed meal when each averaged 8 per cent of the total ration. It is suggested that the gossypol of the cottonseed meal combines with the proteins of the tankage, or similar feed, in the digestive tract of the animal to form an insoluble and therefore harmless compound.

**Potatoes in Pig Feeding.** *J. C. Wallace and J. K. Thomson. Jour. Min. Agric.; Engl.*, 1934, *41*, 562-565.—Steamed potatoes were fed to replace ⅓, ⅔ and the whole of the barley in a ration containing 60 per cent barley meal. The pigs used averaged between 91-93 lb. at the start and were sold at 200 lb. live weight. There was no significant difference in the rate of growth or food utilisation between the different groups, and at the prevailing food prices (not stated) the potato fed groups proved to be the more economical as to cost of production. 4 lb. potatoes were taken as the meat equivalent of 1 lb. barley. No carcase measurements were made. The carcases of the potato-fed pigs were reported to be satisfactory although slightly greasy.

**Rye as Feed for Poultry.** *J. G. Halpin, C. E. Holmes and E. B. Hart. Poultry Sci.*, 1934, *13*, p. 295.—From trials extending over several years the authors conclude that rye is an unsatisfactory feed for young chickens, but may be used in the rations of growing pullets and laying hens with good results.

**The Effect of Confinement Brooding on Growth and Egg Production.** *G. D. Buckner, J. H. Martin and W. M. Insko, jun. Kentucky Agric. Exp. Stat. Res., Bull. No.* 346, *Jan.* 1934, p. 16.—Three groups of chicks were compared. Group I was brooded naturally in colony brooders; Group III was reared in batteries to 22 weeks of age, while Group II received the same treatment as Group III up to 8 weeks, and thereafter was transferred to the colony brooder with Group I. The live weight gains made by the three different groups were similar, but the birds of Group III appeared less active and healthy, had larger combs, and in the case of cockerels, smaller testes than those of the other two groups. The mortality during the first laying year was considerably higher in Group III, while both number and size of eggs were definitely less. There was no difference in the fertility and hatchability of eggs from the groups.

**Reducing Protein Concentrates in Rations of Chicks at Different Ages.** *R. E. Roberts and C. W. Carrick. Poultry Sci.*, 1934, *13*, p. 302.—In three experiments chicks received up to twelve weeks an all-mash ration containing 15 per cent meat and bone scraps and

5 per cent dried milk, or 10 per cent meat and bone scraps, 10 per cent soya bean meal and 5 per cent dried milk, in addition to a basal ration of cereals and alfalfa leaf meal. Other groups received the same ration to 4, 6 and 8 weeks, after which 12 per cent meat and bone scrap and 4 per cent dried milk were substituted. At 12 weeks no difference was found either in the average weight of the various groups or in mortality.

**Salt Requirements of Growing Chicks.** *J. G. Halpin, C. E. Holmes and E. B. Hart. Poultry Sci.*, 1934, *13*, p. 308.—Groups of chicks were fed a ration of cereals, dried milk, alfalfa and meat scraps, to which salt was added at the rate of 0·5 per cent. Mortality was normal except in the group on the high salt level, where it was 30 per cent. The group receiving 1 per cent salt grew faster and started to lay earlier than the other groups.

**Barley for Poultry Feeding: a Comparison with Wheat.** *H. A. Kitto. N.Z. Jour. Agric.*, 1934, *49*, 156-160.—One group of laying pullets was fed barley as 45 per cent of the mash and 100 per cent of the scratch grain, while another was fed wheat in the same amounts. Production in the barley-fed pen was slightly higher for a lower cost of food, while feathering was also better. Consumption of meat meal, which was always available to both lots, was much greater in the case of the group receiving barley, especially in the months of high production.

## ECONOMICS

**Financial Results on certain Devon and Cornish Farms, 1932-3.** *W. H. Long and C. Daniel. Farmer's Report No. 9. Dept. of Econ., Seale-Hayne Agric. Coll., Newton Abbot, Devon. January* 1935.—This Report opens with a comparative statement of the average yearly profit or loss on all the co-operating farms during the ten years 1923-4 to 1932-3.

| Year | No. of farms | Profit or Loss per farm £ |
|---|---|---|
| 1923-4 | 45 | 5 |
| 1924-5 | 63 | 204 |
| 1925-6 | 77 | − 88 |
| 1926-7 | 72 | − 64 |
| 1927-8 | 82 | − 44 |
| 1828-9 | 75 | 168 |
| 1929-30 | 80 | 184 |
| 1930-1 | 87 | − 23 |
| 1931-2 | 91 | −216 |
| 1932-3 | 106 | −131 |

The main features of the period are clearly the two crashes which occurred, the first about 1925 and the second about 1931, followed in each case by gradual recoveries. The first coincides with the country's return to the gold standard in 1925, the second with the financial crisis of 1931.

The remainder of the Report is devoted to a comparison of the returns in the two years 1931-2 and 1932-3, gross output or production, and total expenses being examined in turn, and then the results on different types of farming in Devon and Cornwall. As between the two years, gross output increased by £12 per farm, while there was a saving of £52 in expenditure, but this improvement was due solely to the smaller depreciation of the valuations in 1932-3 than in 1931-2. All the groups except the Mid-Devon group improved their results in 1932-3 compared with the previous year.

**Some Aspects of Smallholdings in the Agricultural Structure.** *A. W. Menzies Kitchin. The Econ. Jour., vol. xliv. December* 1934.—The evidence on which this study is based is contained in three Reports, Nos. 19, 20 and 21 on " An Economic Survey of Agriculture in the Eastern Counties of England," issued by the Department of Agricultural Economics, Cambridge University (2s. 6d.). The production data and financial matters discussed refer to the year 1932, and the purpose of the study is to illustrate certain essential differences in the character and organisation of small and large farms, and to indicate certain lines along which smallholdings might profitably be developed in this country.

It is shown that compared with the large farm, the small farm (*a*) has a greater resistance to low prices, (*b*) produces twice the value of produce per acre, (*c*) provides employment for approximately twice as many men per acre, and (*d*) that the social output per acre, *i.e.* sum of profits, labour and rent, is increased by 80 per cent. Comparisons are made between the incomes of smallholdings in certain districts and between profitable and unprofitable holdings in the same district and an attempt made to analyse the reasons for these differences in income.

The conclusion reached is that the success of smallholdings is mainly a matter of evolving a suitable organisation for the " locality " and that it is not so dependent on type of soil or the existence of a retail market as is generally believed.

**Recent Land Tenure Changes in Mid-Devon.** *J. J. M'Gregor. Economica. November* 1934.—This article summarises the conclusions arrived at as the result of a survey of Mid-Devon farms, with respect to the mobility of farmers and changes in the form of tenure during the past twenty-five years. It discusses the age, occupational history and motives for the movement of the 216 farmers interviewed. Among other things it is noted (1) that the pronounced increase in owner-occupancy occurred in the years during and immediately following the war; (2) tenant-farmers changed farms more frequently than owner-occupiers; (3) where farmers had changed from one farm to another the larger proportion had moved to farms of larger size ; (4) the majority of the explanations given by farmers for the change from one farm to another could be included under the categories of (*a*) progressive business moves, (*b*) difficulties with owners.

**Changes in Permanent Equipment of South Devon Farms.** *J. J. M'Gregor. Seale-Hayne Agric. College. Pamphlet No.* 43. *September* 1934.—" Much real improvement has been carried out through the installation of water and electric supplies, but in other directions there have been difficulties, and the other classes of improvements, as a whole, must be considered very meagre. The fact remains that many of the farmers are carrying on with the equipment planned for conditions not obtaining to-day, and that, in their opinion, the most significant resistance to the changes necessary to make them efficient as judged by modern standards, appears to be lack of capital or cheap credit." These are among the conclusions presented in a pamphlet dealing with the types of improvements introduced in South Devon farms during the past twenty years.

**Statistics of Wages of Agricultural Workers in Various Countries, 1927-34.** *International Labour Office. Geneva,* 1934. 1s.—The main statistics published by competent authorities in the different countries have been collected and presented in as systematic a way as possible. It is a first attempt to cover a field which has hitherto been little explored.

**The Sociological Background of Adult Education in Rural Districts.** *A. W. Ashby. Brit. Inst. Adult Educ. Life and Leisure Pamphlets, No.* 2. 1935. 6d.—" The main immediate task and purpose of adult education in rural areas is that of enriching and extending the intellectual life of all the persons it can get inside its lecture and class-rooms." . . . " If adult education can assist the rural population to use its leisure profitably, if it can increase the personal satisfactions of work and residence in the countryside, it may well change the character of selection in the process of migration. Then if we can find any effective methods of increasing the density of rural population, other than damming population back in an impoverished agriculture and thus obtain a mixture of occupations in villages, we shall begin to get the conditions in which we may build a new rural civilisation which will operate with economy and efficiency."

# STATISTICS

## PRICES OF AGRICULTURAL PRODUCE, FEEDING STUFFS, AND FERTILISERS IN DECEMBER 1934, JANUARY AND FEBRUARY 1935

### LIVE STOCK: Monthly Averages of Prices at certain representative Scottish Markets.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | DECEMBER | | | JANUARY | | | FEBRUARY | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality |
| FAT STOCK:— | | | | | | | | | |
| *CATTLE— | per cwt. *s. d.* | per cwt. *s. d.* | per cwt. *s. d.* | per cwt. *s. d.* | per cwt. *s. d.* | per cwt. *s. d.* | per cwt. *s. d.* | per cwt. *s. d.* | per cwt. *s. d.* |
| Aberdeen-Angus .. | 46 1 | 41 8 | 39 9 | 44 9 | 40 7 | 38 11 | 42 10 | 39 2 | 38 3 |
| Cross-bred (Shorthorn) | 42 3 | 38 3 | 28 8 | 41 0 | 37 6 | 29 6 | 39 10 | 36 6 | 30 7 |
| Galloway .. .. | 39 2 | 36 1 | .. | 37 10 | 35 5 | .. | 37 8 | 35 6 | .. |
| Ayrshire .. .. | 40 1 | 35 6 | 33 0 | 38 11 | 34 6 | 31 1 | 39 2 | 35 6 | 32 4 |
| Blue Grey .. .. | 45 4 | 42 6 | 40 0 | 44 1 | 42 0 | 40 0 | 43 4 | 40 8 | 40 0 |
| Highland .. .. | 38 8 | 38 0 | 36 0 | 38 1 | .. | .. | .. | .. | .. |
| | per lb. *d.* | per lb. *d.* | per lb. *d.* | per lb. *d.* | per lb. *d.* | per lb. *d.* | per lb. *d.* | per lb. *d.* | per lb. *d.* |
| †VEAL CALVES .. .. | 12 | 3½ | .. | 12¾ | 3½ | .. | 14 | 3½ | .. |
| †SHEEP— | Hoggs under 60 lb. per lb. *d.* | 60 lb. and upw'd. per lb. *d.* | Ewes per lb. *d.* | Hoggs under 60 lb. per lb. *d.* | 60 lb. and upw'd. per lb. *d.* | Ewes per lb. *d.* | Hoggs under 60 lb. per lb. *d.* | 60 lb. and upw'd. per lb. *d.* | Ewes per lb. *d.* |
| Cheviot .. .. | 10¾ | 10½ | 6¼ | 10¾ | .. | 6¾ | 11¾ | .. | 7¾ |
| Half-bred .. .. | 10¼ | 10 | 6 | 10½ | 10 | 6½ | 11 | 10¼ | 7¼ |
| Blackface .. .. | 11 | 9¾ | 6¼ | 11 | 10 | 6¾ | 11½ | 10¼ | 7½ |
| Greyface .. .. | 10½ | 10 | 6¼ | 10¾ | 10 | 6 | 11¼ | 10¼ | 7 |
| Down Cross .. .. | 10¾ | 10 | 6 | 10½ | 9¾ | 6½ | 11 | 10½ | 8 |
| †PIGS— | per stone *s. d.* | per stone *s. d.* | per stone *s. d.* | per stone *s. d.* | per stone *s. d.* | per stone *s. d.* | per stone *s. d.* | per stone *s. d.* | per stone *s. d.* |
| Bacon Pigs .. .. | 8 8 | 7 9 | .. | 9 0 | 8 1 | .. | 9 0 | 7 11 | .. |
| Porkers .. .. | 9 7 | 8 6 | .. | 9 11 | 8 11 | .. | 9 10 | 8 9 | .. |

* Live weight. † Estimated dressed carcase weight.

## Live Stock: Monthly Averages of Prices (per head) at certain representative Scottish Markets—(*continued*).

| Description | December | | | January | | | February | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality |
| STORE STOCK:— | | | | | | | | | |
| Cattle— | | | | | | | | | |
| Aberdeen-Angus: | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. |
| Yearlings .. .. | 13 18 | 10 16 | 7 10 | 13 12 | 10 14 | .. | 13 11 | 10 13 | .. |
| Two-year-olds .. | 17 9 | 14 9 | .. | 17 5 | 14 6 | .. | 16 13 | 14 7 | .. |
| Cross-bred (Shorthorn) | | | | | | | | | |
| Yearlings .. .. | 12 18 | 9 5 | 7 5 | 13 0 | 9 3 | .. | 12 19 | 9 6 | .. |
| Two-year-olds .. | 16 4 | 13 10 | .. | 16 8 | 13 11 | 12 10 | 15 19 | 13 9 | .. |
| Galloway: | | | | | | | | | |
| Yearlings .. .. | 11 13 | 10 0 | .. | 11 14 | 9 8 | .. | 11 17 | 9 10 | .. |
| Two-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Ayrshire: | | | | | | | | | |
| Yearlings .. .. | .. | .. | .. | .. | .. | .. | 9 18 | .. | .. |
| Two-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Blue Grey: | | | | | | | | | |
| Yearlings .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Two-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Highland: | | | | | | | | | |
| Yearlings .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Two-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Three-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Dairy Cows— | | | | | | | | | |
| Ayrshire: | | | | | | | | | |
| In milk .. .. | 26 8 | 19 5 | 14 14 | 25 18 | 18 16 | 13 10 | 26 4 | 18 7 | 13 6 |
| Calvers .. .. | 26 10 | 20 0 | 15 8 | 26 5 | 19 6 | 14 16 | 26 4 | 19 2 | 14 15 |
| Shorthorn Cross: | | | | | | | | | |
| In milk .. .. | 27 14 | 20 7 | 19 10 | 27 15 | 20 10 | 19 7 | 27 11 | 20 3 | 17 18 |
| Calvers .. .. | 26 13 | 18 14 | 17 18 | 24 14 | 17 14 | 14 13 | 25 7 | 17 11 | 15 10 |
| Sheep— | | | | | | | | | |
| | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| Cheviot Hoggs .. | .. | .. | .. | 28 0 | .. | .. | 37 4 | 29 6 | .. |
| Half-bred Hoggs .. | 38 6 | 37 3 | 30 6 | 41 0 | 35 11 | .. | 46 4 | 38 8 | 36 3 |
| Blackface Hoggs .. | 22 5 | 16 9 | .. | 26 10 | 20 4 | .. | 27 7 | 19 10 | 14 11 |
| Greyface Hoggs .. | 37 3 | 29 7 | .. | 39 2 | 30 0 | .. | 41 8 | 30 10 | .. |
| Down Cross Hoggs | 37 1 | 30 7 | .. | 37 1 | 34 8 | .. | 39 8 | .. | .. |
| Pigs— | | | | | | | | | |
| (6 to 10 weeks old) | 30 4 | 18 8 | .. | 29 10 | 18 0 | .. | 30 5 | 19 11 | .. |

## DEAD MEAT : Monthly Average Prices at Dundee, Edinburgh, and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | QUALITY | DECEMBER | | | JANUARY | | | FEBRUARY | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Dundee | Edinburgh | Glasgow | Dundee | Edinburgh | Glasgow | Dundee | Edinburgh | Glasgow |
| | | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* |
| **BEEF :—** | | | | | | | | | | |
| Home-fed— | | | | | | | | | | |
| Bullock or Heifer .. | 1 | 7 | 6¾ | 8⅛ | 7⅛ | 6½ | 8¼ | 6⅞ | 6¼ | 8¼ |
| | 2 | 6¼ | .. | 7⅛ | 6⅜ | .. | 7 | 6½ | .. | 7 |
| Bull .. .. .. | 1 | 5½ | 5⅛ | 5½ | 5½ | 5 | 5½ | 5½ | 4⅞ | 5½ |
| | 2 | 4¾ | .. | 5 | 4⅝ | .. | 5 | 4⅞ | .. | 4½ |
| Cow .. .. .. | 1 | 4⅝ | 4¾ | 4½ | 4¾ | 4⅝ | 4¾ | 4⅝ | 4⅝ | 5½ |
| | 2 | 4 | .. | 3½ | 4 | .. | 4⅛ | 4 | .. | 4¾ |
| Irish— | | | | | | | | | | |
| Bullock or Heifer .. | 1 | .. | .. | 7⅛ | .. | .. | 7¼ | .. | .. | 7¼ |
| | 2 | .. | .. | 6⅛ | .. | .. | 6¼ | .. | .. | 6⅜ |
| Argentine Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | 4⅝ | 4 | .. | 4⅝ | 4½ | .. | 4½ | 4½ | .. |
| | 2 | .. | 3½ | .. | .. | 4 | .. | .. | 4 | .. |
| Fore " .. | 1 | 3⅝ | 3¼ | .. | 3⅝ | 3⅝ | .. | 3⅞ | 3¾ | .. |
| | 2 | .. | 2¾ | .. | .. | .. | .. | .. | 3⅜ | .. |
| Argentine Chilled— | | | | | | | | | | |
| Hind Quarters .. | 1 | 6⅛ | 6⅜ | 5⅝ | 6½ | 6¼ | 6 | 6⅛ | 6 | 5¾ |
| | 2 | .. | 5⅝ | .. | .. | 5½ | 5¾ | .. | 5⅜ | 5⅜ |
| Fore " .. | 1 | 4 | 4 | 3¾ | 4⅛ | 4¼ | 4 | 4⅛ | 4⅛ | 3⅝ |
| | 2 | .. | 3½ | 3⅝ | .. | 3½ | 3¾ | .. | 3½ | 3⅜ |
| Australian Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | .. | .. | 3⅝ | .. | .. | 3⅞ | .. | .. | 4 |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Crops .. .. | 1 | .. | .. | 3 | .. | .. | 3¼ | .. | .. | 3⅝ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| New Zealand Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | .. | .. | 3¾ | .. | .. | 3¾ | .. | .. | 4 |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Fore " .. | 1 | .. | .. | 2¾ | .. | .. | 3 | .. | .. | 3¼ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **MUTTON :—** | | | | | | | | | | |
| Hoggs, Blackface .. | under 60 lb. | 9⅝ | 9¼ | 10 | 10¼ | 10 | 10⅝ | 10⅞ | 10¾ | 11¼ |
| | 60 lb. & over | 9 | .. | 9¾ | 9¼ | .. | 10⅜ | 9⅞ | .. | 10¾ |
| " Cross .. | under 60 lb. | 9⅝ | 9¼ | 10 | 10¼ | 10 | 10⅝ | 10⅞ | 10¾ | 11¼ |
| | 60 lb. & over | 9 | .. | 9¾ | 9¼ | .. | 10⅜ | 9⅞ | .. | 10¾ |
| Ewes, Cheviot .. | 1 | .. | 6 | 6¼ | .. | 6⅛ | 7 | .. | 7⅛ | 8¼ |
| | 2 | .. | .. | 6 | .. | .. | 6⅝ | .. | .. | 7⅞ |
| " Blackface .. | 1 | 6⅜ | 6 | 6¼ | 6¾ | 6⅛ | 7 | 7¾ | 7⅛ | 8¼ |
| | 2 | 5⅝ | .. | 6 | 6¼ | .. | 6⅝ | 7¼ | .. | 7⅞ |
| " Cross .. .. | 1 | 5 | 6 | 6⅛ | 5⅝ | 6⅛ | 7 | 6 | 7⅛ | 8¼ |
| | 2 | 4 | .. | 5⅞ | 4 | .. | 6⅝ | 5 | .. | 7⅞ |
| Argentine Frozen .. | 1 | .. | .. | 3½ | .. | .. | 3¾ | .. | .. | 4 |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Australian " .. | 1 | .. | 5 | 3¾ | .. | 5⅞ | 3⅞ | .. | 5⅝ | 4 |
| | 2 | .. | 3⅜ | .. | .. | 4⅜ | .. | .. | 4 | .. |
| New Zealand " .. | 1 | .. | .. | 4⅞ | .. | .. | 4¾ | .. | .. | 4¾ |
| | 2 | .. | .. | 3¾ | .. | .. | 4 | .. | .. | 4⅜ |
| **LAMB :—** | | | | | | | | | | |
| Home-fed .. .. | 1 | .. | .. | 10¼ | .. | .. | 10⅞ | .. | .. | 11⅜ |
| | 2 | .. | .. | 9¾ | .. | .. | 10½ | .. | .. | 11⅛ |
| New Zealand Frozen | 1 | .. | 7⅜ | 7 | .. | 8⅝ | 7¼ | .. | 8 | 7½ |
| | 2 | .. | 6⅜ | .. | .. | 7⅝ | .. | .. | 7⅜ | .. |
| Australian " .. | 1 | .. | .. | 6½ | .. | .. | 6¾ | .. | .. | 7 |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Argentine " .. | 1 | .. | .. | 6½ | .. | .. | 6¾ | .. | .. | 7 |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **PORK :—** | | *per cwt*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* |
| Home-fed .. .. | 1 | 84 0 | 75 3 | 75 10 | 81 2 | 77 7 | 76 6 | 82 10 | 78 2 | 79 4 |
| | 2 | 46 8 | .. | 70 0 | 41 1 | .. | 70 0 | 37 4 | .. | 70 0 |
| Imported .. .. | 1 | .. | .. | 63 0 | .. | .. | 60 8 | .. | .. | 60 8 |

## EGGS: Monthly Average Wholesale Prices at Aberdeen, Kilmarnock, Lanarkshire, and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | | WEIGHT PER 120 | QUALITY | DEC. | JAN. | FEB. |
|---|---|---|---|---|---|---|
| | | lb. | | s. d. | s. d. | s. d. |
| **ABERDEEN—** | | | | | | |
| Country .. .. | per doz. | .. | 1 | 1 6¼ | 1 3 | 1 1¼ |
| | | .. | 2 | 1 2½ | .. | .. |
| Duck .. .. | " | .. | 1 | .. | 1 4 | 1 2¼ |
| | | .. | 2 | .. | 1 3 | .. |
| **KILMARNOCK—** | | | | | | |
| Country (ungraded) | per doz. | .. | 1 | 1 9¼ | 1 6 | 1 3¼ |
| **LANARKSHIRE—** | | | | | | |
| Country "Standard" | per doz. | .. | .. | 2 1¼ | 1 9 | 1 6½ |
| **GLASGOW—** | | | | | | |
| National Mark— | | | | | | |
| "Special" .. | per doz. | .. | .. | 1 11 | 1 7¼ | 1 4¼ |
| "Standard" .. | " | .. | .. | 1 9½ | 1 6 | 1 3 |
| "Medium" .. | " | .. | .. | 1 7¾ | 1 4¾ | 1 2 |
| "Special" .. | per 120 | .. | .. | 19 1 | 16 0 | 13 4 |
| "Standard" .. | " | .. | .. | 17 11 | 15 1 | 12 6 |
| "Medium" .. | " | .. | .. | 15 10 | 13 11 | 11 6 |
| Northern Ireland | " | 17 | .. | 18 11 | 15 1 | 13 1 |
| " | " | 15½ | .. | 17 7 | 14 0 | 12 2 |
| " | " | 14 | .. | 15 7 | 12 10 | 11 3 |
| " (Duck) | " | .. | 1 | 14 11 | 13 6 | 13 0 |
| Irish Free State .. | " | 16 | .. | 17 6 | 13 8 | 11 7 |
| " .. | " | 15 | .. | 16 11 | 13 1 | 11 2 |
| " .. | " | 14 | .. | 13 9 | 12 3 | 10 0 |
| " (Duck) | | | 1 | 14 5 | 13 0 | 12 2 |
| Australian .. | " | 16 | .. | 13 1 | .. | .. |
| " .. | " | 15 | .. | 12 5 | 11 9 | .. |
| " .. | " | 14 | .. | 11 9 | .. | .. |
| Belgian .. .. | " | 15½ | .. | 13 2 | .. | .. |
| Danish .. .. | " | 15½ | .. | 15 8 | 11 7 | 10 3 |
| " .. .. | " | 14 | .. | .. | 9 4 | .. |
| " (Cold Stored, ungraded) | " | .. | 1 | 10 5 | .. | .. |
| Dutch .. .. | " | 15½ | .. | .. | .. | 10 3 |
| " (Duck) | " | .. | 1 | .. | 9 3 | .. |
| Finnish .. .. | " | 17 | .. | .. | .. | 10 6 |
| " .. .. | " | 15½ | .. | .. | .. | 9 11 |
| Norwegian .. | " | 15½ | .. | 13 11 | 10 7 | .. |
| Swedish .. .. | " | 15½ | .. | .. | 10 10 | 10 2 |
| " .. .. | " | 14 | .. | .. | 8 9 | .. |
| Polish (ungraded) | " | .. | 1 | 7 5 | 7 0 | 6 3 |
| " ( " ) | " | .. | 2 | 7 3 | .. | .. |

## PROVISIONS: Monthly Average Wholesale Prices (per cwt.) at Glasgow.

| DESCRIPTION | QUALITY | DEC. | JAN. | FEB. |
|---|---|---|---|---|
| | | s. d. | s. d. | s. d. |
| **BUTTER—** | | | | |
| Australian .. .. .. | 1 | 76 0 | 86 0 | 95 0 |
| Danish .. .. .. | 1 | 126 6 | 123 0 | 121 9 |
| " (unsalted) .. .. | 1 | 129 6 | 126 2 | 125 3 |
| New Zealand .. .. .. | 1 | 77 9 | 88 2 | 95 9 |
| | 2 | 76 4 | .. | 93 4 |
| " (unsalted) .. .. | 1 | 80 3 | 91 7 | 98 9 |
| Swedish .. .. .. | 1 | 111 0 | 112 7 | 110 0 |
| " (Cold Stored) .. .. | 1 | 95 0 | .. | .. |
| Latvian .. .. .. | 1 | .. | 105 0 | 103 0 |
| " (Cold Stored) .. .. | 1 | 87 6 | .. | .. |
| **CHEESE—** | | | | |
| Cheddar .. .. .. .. | 1 | 75 0 | 75 0 | 75 0 |
| | 2 | 56 0 | 53 7 | 52 0 |
| Cheddar Loaf .. .. .. | 1 | 76 0 | 76 0 | 76 0 |
| | 2 | 72 0 | 72 0 | 72 0 |
| Dunlop .. .. .. | 1 | 60 0 | 60 0 | 60 0 |
| | 2 | 48 0 | 48 0 | 48 0 |
| Canadian .. .. .. | 1 | 62 0 | 62 0 | 62 0 |
| | 2 | 57 6 | 58 0 | 58 0 |
| New Zealand (Coloured) .. | 1 | 50 9 | 52 7 | 53 6 |
| " (White) .. .. | 1 | 55 0 | 54 2 | 54 3 |
| **HAMS—** | | | | |
| Irish (Smoked) .. .. .. | 1 | 132 0 | 132 0 | 144 6 |
| | 2 | 113 3 | 121 0 | 134 6 |
| American (Short Cut, Green) .. | 1 | 90 0 | 98 0 | 95 6 |
| Canadian (Long Cut, " ) .. | 1 | 92 0 | 99 7 | 99 6 |
| **BACON**—Ayrshire (Rolled) .. | 1 | 116 8 | 121 4 | 116 8 |
| | 2 | 112 0 | 116 8 | 112 0 |
| English Wiltshire (Green) .. | 1 | 97 6 | 99 10 | 103 0 |
| | 2 | 92 6 | 95 7 | 96 6 |
| " (Dried or Smoked) .. | 1 | 101 6 | 103 10 | 107 0 |
| | 2 | 96 6 | 99 7 | 100 6 |
| Irish (Green, Wiltshire Style) .. | 1 | 97 0 | 100 2 | 100 0 |
| | 2 | 95 0 | 98 2 | 95 9 |
| " (Dried or Smoked) .. | 1 | 101 0 | 104 2 | 104 0 |
| | 2 | 99 0 | 102 2 | 99 9 |
| " (Long Clear) .. .. | 1 | 108 0 | 111 2 | 111 0 |
| | 2 | 105 0 | 108 2 | 105 9 |
| Canadian Sides (Green) .. | 1 | 83 9 | 83 10 | 81 9 |
| Danish Sides .. .. .. | 1 | 98 0 | 99 2 | 97 6 |
| Dutch (Green, Wiltshire Style) | 1 | 93 0 | 94 2 | 91 0 |
| **LARD**—American .. .. | 1 | 54 3 | 62 5 | 66 0 |

## FRUIT AND VEGETABLES: Monthly Average Wholesale Prices at Glasgow.

(*Compiled from Returns received from the Department's Market Reporter*)

| DESCRIPTION | | QUALITY | DECEMBER | JANUARY | FEBRUARY |
|---|---|---|---|---|---|
| **FRUIT:—** | | | | | |
| **Apples—** | | | | | |
| | per | | *s. d.* | *s. d.* | *s. d.* |
| British Cooking .. | cwt. | 1 | 12 0 | 15 0 | 15 0 |
| American .. .. | case.† | 1 | 11 1 | 11 9 | 10 9 |
| „ .. .. | barrel.†† | 2 | 19 10 | 17 11 | 18 7 |
| **Pears—** | | | | | |
| Californian .. .. | box.‖ | 1 | 15 4 | 16 8 | 17 2 |
| **VEGETABLES:—** | | | | | |
| **Beans—** | | | | | |
| Dwarf .. .. .. .. | lb. | 1 | 0 6 | 0 6½ | 0 6 |
| Beet .. .. .. .. | cwt. | 1 | 6 0 | 6 0 | 5 6 |
| Brussels Sprouts (Scottish) | „ | 1 | 14 0 | 16 0 | 17 0 |
| „ (English) | net.ø | 1 | 2 8 | 2 11 | 3 6 |
| **Cabbage—** | | | | | |
| Coleworts .. .. | dozen. | 1 | 1 0 | 1 0 | 1 0 |
| Red .. .. .. .. | „ | 1 | 2 8 | 2 6 | 2 9 |
| Savoy .. .. .. .. | „ | 1 | 1 6 | 1 6 | 1 6 |
| **Carrots—** | | | | | |
| British .. .. .. | cwt. | 1 | 5 0 | 5 0 | 5 0 |
| **Cauliflowers—** | | | | | |
| Broccoli, Cornish .. | dozen. | 1 | 4 3 | 4 2 | 4 0 |
| Other British .. .. | „ | 1 | 3 6 | 3 7 | 3 2 |
| French .. .. .. | „ | 1 | .. | 5 3 | 4 6 |
| Celery .. .. .. | bunch. | 1 | 2 0 | 2 0 | 1 8 |
| „ (Washed) .. .. | box.§ | 1 | 3 5 | 3 6 | .. |
| Cucumbers .. .. | dozen. | 1 | 14 0 | .. | .. |
| Greens .. .. .. | bunch. | 1 | 0 6 | 0 6 | 0 6 |
| Leeks .. .. | dozen bunches. | 1 | 1 11 | 2 0 | 2 0 |
| **Lettuce—** | | | | | |
| Cabbage .. .. | dozen. | 1 | 2 0 | 2 1 | 2 6 |
| **Onions—** | | | | | |
| *Spring* .. .. .. | bunch. | 1 | 0 5¾ | 0 5½ | 0 5 |
| *Dutch* .. .. .. | bag.** | 1 | 7 5 | 8 0 | 7 6 |
| *Valencia* .. .. | case.†† | 1 | 8 6 | 9 7 | 8 11 |
| Parsley .. .. .. | cwt. | 1 | 8 0 | 8 0 | 9 6 |
| Parsnips .. .. .. | „ | 1 | 8 0 | 8 0 | 8 0 |
| Radishes .. .. | dozen bunches. | 1 | .. | .. | 1 6 |
| Rhubarb .. .. .. | cwt. | 1 | 60 0 | 33 7 | 27 0 |
| Spinach .. .. .. | stone. | 1 | 4 0 | 4 0 | 4 0 |
| **Tomatoes—** | | | | | |
| Scottish .. .. | lb. | 1 | 0 5¾ | .. | .. |
| Canary .. .. | „ | 1 | 0 3½ | 0 3 | 0 2½ |
| Turnips .. .. | cwt. | 1 | 1 10 | 1 11 | 1 11 |
| Vegetable Marrow .. | dozen | 1 | 6 0 | .. | .. |

† 40 lb. (approx.). †† 9 stone. (approx.). ‖ 46 lb. (approx.).
ø 20 lb (approx.). § 24 heads. ** 7½ stone. (approx.).

## POTATOES : Monthly Average Wholesale Prices (per ton) at Aberdeen, Dundee, Edinburgh, and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| MARKET | Quality | First Earlies | Second Earlies | Late Varieties: Red Soils: Golden Wonder | Late Varieties: Red Soils: Other | Late Varieties: Other Soils: Golden Wonder | Late Varieties: Other Soils: Other |
|---|---|---|---|---|---|---|---|
| | | DECEMBER | | | | | |
| | | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Aberdeen .. | 1 | .. | .. | .. | .. | 4 11 3 | 3 11 11 |
| Dundee .. | 1 | .. | .. | .. | .. | 4 10 0 | 2 19 2 |
| Edinburgh .. | 1 | .. | .. | .. | .. | .. | 3 12 6 |
| Glasgow .. | 1 | .. | 3 7 6 | .. | .. | 4 7 6 | 3 15 0 |
| | | JANUARY | | | | | |
| Aberdeen .. | 1 | .. | .. | .. | .. | 4 15 0 | 3 15 0 |
| Dundee .. | 1 | .. | .. | .. | .. | 4 8 0 | 2 17 0 |
| Edinburgh .. | 1 | .. | .. | .. | .. | .. | 3 10 0 |
| Glasgow .. | 1 | .. | 2 19 0 | .. | .. | 4 15 0 | 3 9 0 |
| | | FEBRUARY | | | | | |
| Aberdeen .. | 1 | .. | .. | .. | .. | 4 15 0 | 3 15 0 |
| Dundee .. | 1 | .. | .. | .. | .. | 4 10 0 | 2 15 0 |
| Edinburgh .. | 1 | .. | .. | .. | .. | .. | 3 7 6 |
| Glasgow .. | 1 | .. | 2 15 0 | .. | .. | 4 12 6 | 3 5 0 |

## ROOTS, HAY, STRAW, AND MOSS LITTER : Monthly Average Prices (per ton) at Aberdeen, Dundee, Edinburgh, and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| MARKET | Quality | Roots: Carrots | Roots: Yellow Turnips | Roots: Swedes | Hay: Rye Grass and Clover | Hay: Timothy | Straw: Wheat | Straw: Barley | Straw: Oat | Moss Litter |
|---|---|---|---|---|---|---|---|---|---|---|
| | | DECEMBER | | | | | | | | |
| | | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| *Aberdeen .. | 1 | .. | .. | .. | 70 0 | .. | .. | .. | 40 0 | .. |
| †Dundee .. | 1 | .. | .. | ø21 3 | 95 0*a*<br>85 0*b* | .. | 43 9 | .. | 55 0 | .. |
| ‖Edinburgh .. | 1 | .. | .. | .. | 90 0*a*<br>85 0*b* | .. | 27 6 | .. | 27 6 | .. |
| *a*Glasgow .. | 1 | .. | .. | .. | 80 0 | 90 0 | 35 0 | .. | 45 0 | 33 4*c* |
| | | JANUARY | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 70 0 | .. | .. | .. | 43 0 | .. |
| †Dundee .. | 1 | .. | .. | ø20 0 | 97 0*a*<br>89 0*b* | .. | 45 6 | .. | 59 0 | .. |
| ‖Edinburgh .. | 1 | .. | .. | .. | 89 5*a*<br>84 5*b* | .. | 26 3 | .. | 28 2 | .. |
| *a*Glasgow .. | 1 | .. | .. | .. | 80 0 | 90 0 | 35 0 | .. | 48 0 | 33 9*c* |
| | | FEBRUARY | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 68 9 | .. | .. | .. | 40 0 | .. |
| †Dundee .. | 1 | .. | .. | ø18 3 | 100 0*a*<br>90 0*b* | .. | 44 5 | .. | 63 9 | .. |
| ‖Edinburgh .. | 1 | .. | .. | .. | 85 8*a*<br>82 6*b* | .. | 25 0 | .. | 30 0 | .. |
| *a*Glasgow .. | 1 | .. | .. | .. | 82 6 | 90 0 | 35 0 | .. | 50 0 | 33 9*c* |

* Ex farm, loose.
† Baled straw, delivered in town.
‖ Bunched or baled straw, delivered.
ø Delivered in town.
*a* Baled and delivered.
*b* Delivered, loose.
*c* Home Moss Litter, in 1½-cwt. bales.

## FEEDING STUFFS: Monthly Average Prices (per ton) at Glasgow and Leith.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | DECEMBER | | JANUARY | | FEBRUARY | |
|---|---|---|---|---|---|---|
| | Glasgow | Leith | Glasgow | Leith | Glasgow | Leith |
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Linseed Cake— | | | | | | |
| Home | 8 16 7 | 8 15 0 | 8 18 0 | 8 15 0 | 8 13 9 | 8 10 0 |
| Foreign | 8 5 0 | 8 6 11 | 8 7 9 | 8 8 6 | 8 9 1 | 8 5 0 |
| Decort. Cotton Cake | 7 1 11 | .. | 7 4 0 | .. | 7 13 9 | .. |
| Undecort. Cotton Cake— | | | | | | |
| Egyptian (Home manufactured) | 5 6 3 | 5 6 11 | 5 7 0 | 5 5 6 | 5 3 2 | 5 1 11 |
| Palmnut Kernel Cake | 7 13 9 | .. | 7 15 0 | .. | 7 15 0 | .. |
| Soya Bean Cake | 8 0 0 | .. | 8 0 0 | .. | 8 0 0 | .. |
| Coconut Cake | 6 10 8 | .. | 6 18 6 | .. | 7 0 0 | .. |
| Groundnut Cake, undecort.— | | | | | | |
| (50 % Oil and Album.) | 6 11 11 | 6 11 3 | 7 2 6 | 7 1 3 | 7 5 8 | 7 3 9 |
| (54 % „ „ ) | 6 11 11 | .. | 7 2 0 | .. | 7 6 11 | .. |
| Maize Germ Cake, Home mfd. | 7 16 11 | .. | 7 16 6 | .. | 7 15 11 | .. |
| „ „ Meal | 6 7 2 | .. | 6 7 3 | .. | 6 1 7 | .. |
| Rice Meal | 5 9 5 | 5 7 6 | 5 12 0 | 5 7 6 | 5 9 5 | .. |
| Bean Meal | 8 16 3 | 8 10 0 | 8 14 9 | 8 10 0 | 8 15 4 | 8 10 0 |
| Barley Meal | 8 3 2 | 7 7 6 | 7 19 6 | 7 15 0 | 8 0 8 | 7 15 0 |
| Fish Meal | 15 16 11 | 15 14 5 | 15 12 6 | 15 15 0 | 15 0 8 | 15 6 11 |
| Maize Meal— | | | | | | |
| Home manufactured | 6 10 0 | 6 10 8 | 6 6 6 | 6 6 3 | 6 0 0 | 6 0 8 |
| South African, Yellow | 5 18 9 | 5 16 11 | 5 15 9 | 5 16 8 | 5 12 8 | 5 12 6 |
| „ „ White | 5 15 8 | .. | 5 13 6 | .. | 5 11 3 | .. |
| Locust Bean Meal | 8 7 6 | 7 8 9 | 8 11 6 | 7 10 0 | 8 10 8 | 7 10 0 |
| Maize Gluten Feed (Paisley) | 6 7 6 | .. | 6 7 6 | .. | 6 6 7 | .. |
| Maize— | | | | | | |
| Plate | 5 13 2 | 5 11 11 | 5 10 0 | 5 10 0 | 5 5 0 | 5 1 11 |
| African | 6 6 3 | .. | 6 8 9 | .. | 6 7 6 | .. |
| Oats— | | | | | | |
| Home | 7 10 11 | 6 15 8 | 7 6 6 | 6 18 6 | 6 16 3 | 6 19 1 |
| Barley— | | | | | | |
| Home | .. | 7 0 0 | .. | 7 0 0 | .. | 6 10 0 |
| Imported | 7 2 6 | 6 13 9 | 7 1 9 | 6 13 0 | 7 1 3 | 6 8 2 |
| Wheat— | | | | | | |
| Home | 5 15 0 | 5 10 0 | 5 12 3 | 5 6 6 | 5 9 1 | 5 1 3 |
| „ (Poultry) | 5 9 1 | .. | 5 6 6 | .. | 5 2 6 | .. |
| Imported | .. | 5 10 0 | .. | 5 5 8 | .. | 5 5 0 |
| Middlings (Fine Thirds or Parings) | 6 15 11 | 6 15 0 | 6 12 6 | 6 13 0 | 6 9 8 | 6 12 6 |
| Sharps (Common Thirds) | 6 13 5 | 6 13 9 | 6 11 6 | 6 12 6 | 6 5 2 | 6 12 6 |
| Bran (Medium) | 6 12 10 | 6 13 2 | 6 12 0 | 6 15 0 | 6 5 0 | 6 12 10 |
| „ (Broad) | 7 3 2 | 7 1 3 | 6 18 6 | 7 2 3 | 6 18 9 | 7 0 0 |
| Malt Culms | 5 2 6 | 5 2 6 | 5 2 6 | 5 5 0 | 5 3 5 | .. |
| Distillers' Mixed Grains (Dried) | .. | 5 16 3 | .. | 6 0 0 | .. | 5 15 0 |
| Distillers' Malt Grains (Dried) | 6 19 5 | .. | 6 19 9 | .. | 7 0 8 | .. |
| Brewers' Grains (Dried) | 6 6 7 | 5 13 9 | 6 6 9 | 5 12 6 | 6 13 2 | 5 12 6 |
| Crushed Linseed | 17 2 6 | .. | 16 6 0 | .. | 16 0 0 | .. |
| Locust Beans (Kibbled and Stoned) | 7 8 2 | 7 3 9 | 7 10 9 | 7 9 0 | 7 14 8 | 7 10 0 |
| Beans— | | | | | | |
| English | 8 5 0 | .. | .. | .. | .. | .. |
| China | 7 18 9 | 7 15 0 | 7 18 9 | 7 15 0 | 7 17 10 | 7 15 0 |
| Egyptian | 8 0 0 | .. | 8 0 0 | .. | 8 0 0 | .. |
| Rangoon (Red) | .. | 6 10 0 | .. | 6 10 0 | .. | 6 10 0 |
| „ (White) | 7 0 0 | 6 15 0 | 6 19 6 | 6 15 0 | 6 19 5 | 6 15 0 |
| Pease— | | | | | | |
| Karachi (White) | 8 15 0 | .. | 8 16 6 | .. | 9 2 6 | .. |
| Feeding Treacle | 5 5 0 | 5 10 0 | 5 5 6 | 5 10 0 | 5 5 8 | 5 10 0 |
| Sugar-Beet Pulp (English) | 6 6 7 | 6 2 6 | 6 4 0 | 6 2 6 | 6 3 5 | 6 2 6 |
| „ „ „ (Irish) | 6 5 8 | 5 17 6 | 6 5 0 | 5 17 6 | 6 3 9 | 6 2 6 |
| Linseed Oil, per gall. | 0 4 0 | .. | 0 4 0 | .. | 0 4 0 | .. |

## FERTILISERS: Monthly Average Prices (per ton) at Glasgow and Leith.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | Guaranteed Analysis | DECEMBER | | JANUARY | | FEBRUARY | |
|---|---|---|---|---|---|---|---|
| | | Glasgow | Leith | Glasgow | Leith | Glasgow | Leith |
| | % | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Nitrate of Soda * | N. 15·5 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 |
| Sulphate of Ammonia (Neutral and Granular) * .. | N. 20·6 | 7 0 6 | 6 19 0 | 7 2 0 | 7 2 0 | 7 3 6 | 7 3 6 |
| Calcium Cyanamide † | N. 20·6 | 7 0 0 | 6 17 6 | 7 1 3 | 7 1 3 | 7 2 6 | 7 2 6 |
| Nitrochalk * .. | N. 15·5 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 |
| Superphosphate .. | P.A. 13·7 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 |
| ,, .. | ,, 16·0 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 |
| ,, .. | ,, 18·3 | 3 2 6 | 3 2 6 | 3 2 6 | 3 2 6 | 3 2 6 | 3 2 6 |
| Ground Mineral Phosphate ** .. | P.A. 27·5 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 |
| ,, ,, ,, ** .. | ,, 34 | 3 10 0 | 3 10 0 | 3 10 0 | 3 10 0 | 3 10 0 | 3 10 0 |
| Potassic Mineral Phosphate | P.A. 18<br>Pot. 10 | 3 10 0 | .. | 3 10 0 | .. | 3 10 0 | .. |
| ,, ,, ,, | P.A. 18<br>Pot. 9 | .. | 3 5 0 | .. | 3 5 0 | .. | 3 5 0 |
| ,, ,, ,, | P.A. 20<br>Pot. 7.5 | 3 5 0 | .. | 3 5 0 | .. | 3 5 0 | .. |
| ,, ,, ,, | P.A. 21<br>Pot. 10 | .. | 3 10 0 | .. | .. | .. | .. |
| Kainit (in bags) .. | Pot. 14 | 3 0 0 | 2 17 6 | 3 0 0 | 2 17 6 | 3 0 0 | 2 17 6 |
| Potash Salts .. | Pot. 20 | 3 15 0 | 3 10 0 | 3 15 0 | 3 10 0 | 3 15 0 | 3 10 0 |
| ,, ,, .. | ,, 30 | 4 10 0 | 4 2 6 | 4 10 0 | 4 2 6 | 4 10 0 | 4 2 6 |
| Muriate of Potash (on basis of 80 per cent. purity) | Pot. 50 | 6 17 6 | 6 7 6 | 6 17 6 | 6 10 0 | 6 17 6 | 6 10 0 |
| Sulphate of Potash (on basis of 90 per cent. purity) | Pot. 48·6 | 7 17 6 | 7 7 6 | 7 17 6 | 7 10 0 | 7 17 6 | 7 10 0 |
| Steamed Bone Flour | N. 0·8<br>P.A. 28 | 6 3 9 | 6 2 6 | 6 5 0 | .. | 6 5 0 | .. |
| ,, ,, ,, | N. 0.8<br>P.A. 30 | .. | .. | .. | 5 16 6 | .. | 5 15 0 |
| Bone Meal (Indian) | N. 4<br>P.A. 20 | 6 15 0 | 5 17 6 | 6 15 0 | 6 10 0 | 6 15 0 | 6 10 0 |
| Potassic Slag | P.A. 12<br>Pot. 6 | .. | 3 7 6 | .. | .. | .. | .. |
| Basic Slag ‡ .. | P.A. 12 | 2 5 0 | .. | 2 5 0 | .. | 2 5 0 | .. |
| ,, ,, .. | ,, 13 | 2 7 0 | §1 14 6 | 2 7 0 | 1 5 6 | 2 7 0 | 1 5 6 |
| ,, ,, .. | ,, 14 | 2 9 0 | §1 16 6 | 2 9 0 | 1 7 6 | 2 9 0 | 1 7 6 |
| ,, ,, .. | ,, 15 | .. | §1 18 6 | .. | 1 10 0 | .. | 1 10 0 |
| ,, ,, .. | ,, 15·75 | .. | §2 0 0 | .. | .. | .. | .. |
| ,, ,, (Imported)‖ | ,, 15 | .. | 2 10 0 | .. | 2 10 0 | .. | 2 10 0 |

Abbreviations:—N.=Nitrogen; P.A.=Phosphoric Acid; Pot.=Potash.

* Carriage paid, in 6-ton lots. † Carriage paid, in 4-ton lots.

** Fine grist, 90 per cent fineness through prescribed sieve.

‡ Basic Slag:—At Glasgow—80 per cent citric soluble and 80 per cent fineness; F.o.r., in 6-ton lots. At Leith—80 per cent citric soluble and 80 per cent fineness. On rail at Middlesboro'; carriage paid to Border stations 13s. to 15s. extra, and to Lothian stations 16s. to 17s. extra.

§ F.o.r. Grangemouth. ‖ Ex-store: 2s. 6d. per ton less ex-ship, Leith.

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# OX WARBLE FLIES

R. STEWART MACDOUGALL, M.A., D.Sc., LL.D.

THE warble flies from their hairiness and colour look more or less like humble bees. Two species are enemies of cattle in Scotland, viz., *Hypoderma lineatum* and *Hypoderma bovis*, while a third species, *Hypoderma diana*, is an enemy of the Red deer. The Deer warble fly is mentioned here because of the belief in various parts of Scotland that it may also infest cattle and cause, as larvæ, swellings or warbles under the skin of cattle and so help to spoil hides. There is no proof of this. The Deer warble fly has, however, an economic importance of its own, as its larvæ or maggots spoil the deer hides for glove-making and other purposes.

In Scotland cattle are the hosts of the two warble flies, all breeds being attacked, including Highland cattle. In America the bison may be a host animal and in India larvæ of *H. lineatum* have been found parasitic on the goat; but the normal warble fly of the goat in India is *Hypoderma crossii.*

*H. bovis* measures just over half an inch in length, while *H. lineatum* is a little smaller; in *H. lineatum* there are four conspicuous dark lines down the middle region of the upper part of the fore-body, while in *H. bovis* a tuft of yellow hairs on this fore-body region hides the dark lines.

The Ox warble flies are harmful to cattle in two of their stages. The winged flies terrify cattle and cause them to gad; while their larvæ interfere with the health of the animals and in their later stages, in swellings under the skin of the back, spoil and may ruin the hide.

**Characteristics and Habits of the Flies.**—They love sunshine. *H. lineatum*, which appears in summer a month earlier than *H. bovis*, is not, however, so dependent on sunshine. They fly well. Not enough is known concerning the distances warble flies can cover in flight, but there is a record of nine miles. A warble fly cannot bite or sting, but an instinctive dread is induced in cattle by the come and go of the egg-laying female and by the hum—not loud, but low, and sufficiently audible to make Bishopp write of the "listening attitude" of the cattle—when the fly is near. Sensitiveness is increased when the minute larvæ from the fly's eggs are boring into the skin. Hadwen repeatedly observed how the flies—*H. bovis* especially—by their persistency, worried and disheartened the beasts. The flies do not suck blood; they cannot wound; they do not feed; the nourishment necessary for the development of the eggs is obtained from the store of reserve laid up by the larvæ or maggots, which, in the course of their life, feed in the body of the animal and under the skin of the back. The adult fly is short-lived.

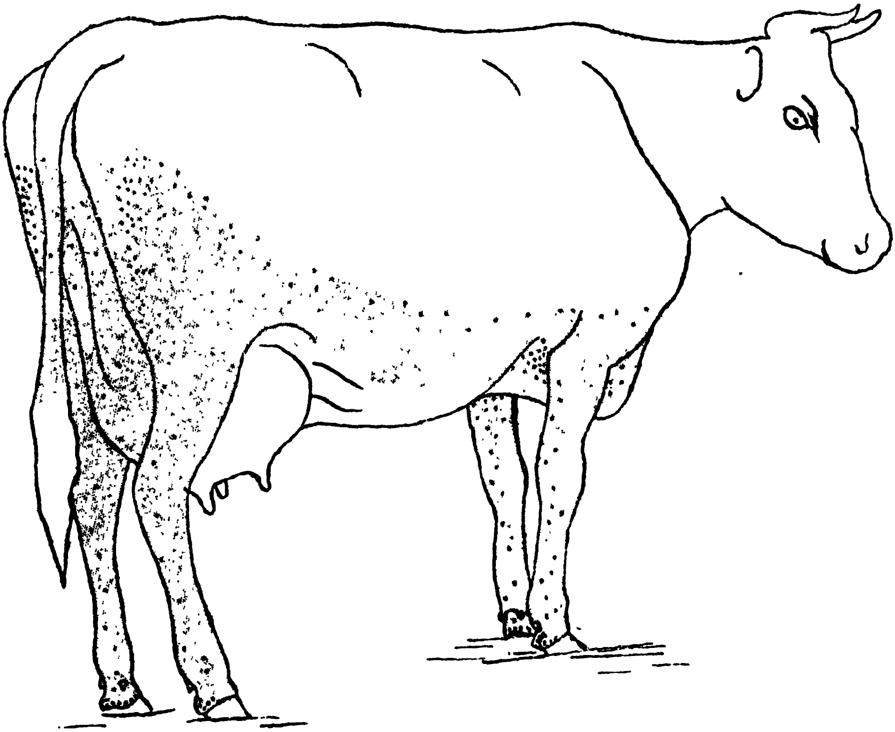

FIG. 2.—This is a drawing from a figure by Dr SEYMOUR HADWEN. The black spots or dots indicate the places where most eggs have been found; the shaded parts indicate the whole area where eggs may be deposited. The figure is for both species of warble fly.

**Life History.**—The life-cycle is an annual one, a single generation in the year. Most of the year is passed in the larval or maggot condition, the earlier stages for months internally and out of view in the tissues of the host animal, and the later larval stages in swellings under the skin of the back. The earliest adults of *H. lineatum* issue from their pupal-cases in the soil in the first days of summer, those of *H. bovis* later on. After pairing, the female, by extending her ovipositor or egg-laying tube, lays her eggs chiefly on the hairs of the legs, low down; *H. lineatum* is known as the heel-fly because of this. A female in the course of her life may lay 600 to 800 eggs.

The egg, dull white in colour with a smooth shell, is provided with a grooved appendage or stalk which fits over the hair (Fig. 1),

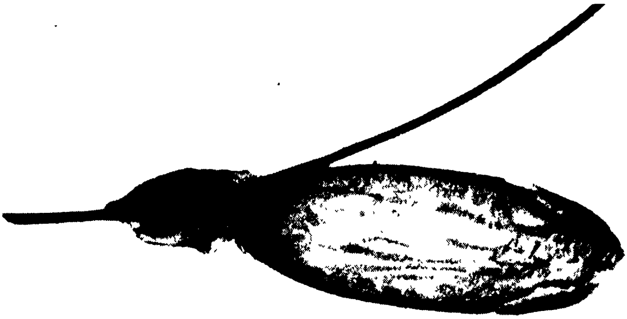

FIG. 1.—Egg of *Hypoderma bovis*. From nature, greatly magnified.

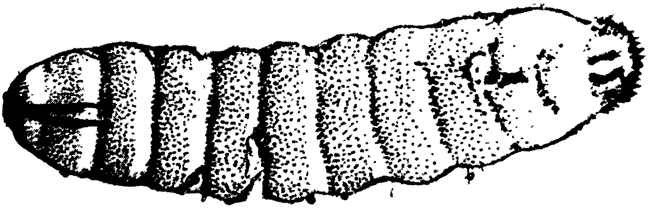

FIG. 3.—First-stage larva of *Hypoderma bovis*. From nature, greatly magnified.

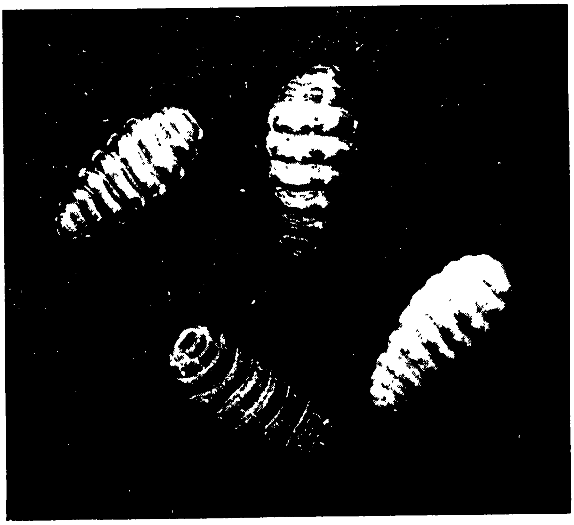

FIG. 4.—Full-grown larva of *Hypoderma bovis*. From nature.

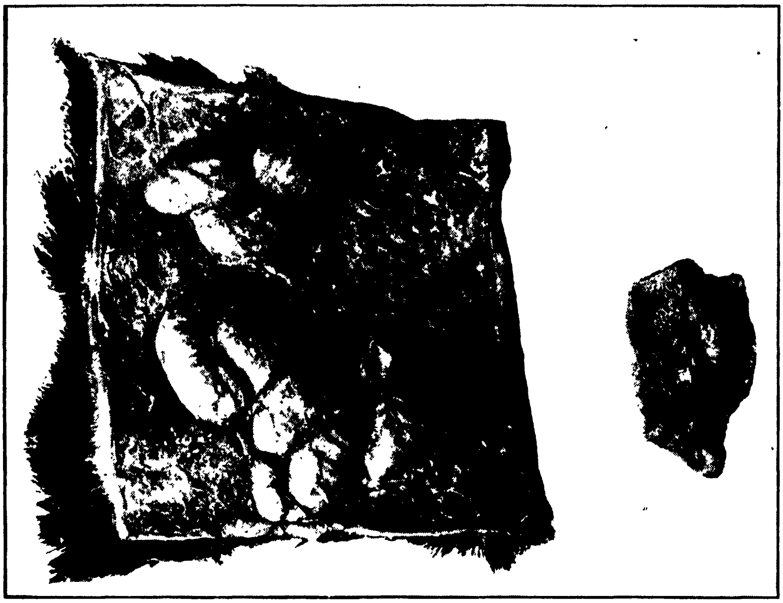

Fig. 5.— Inner side of hide of ox showing larval cysts; in each is a larva of *Hypoderma bovis*. In the smaller figure a cyst has been opened to expose the larva. From nature, reduced.

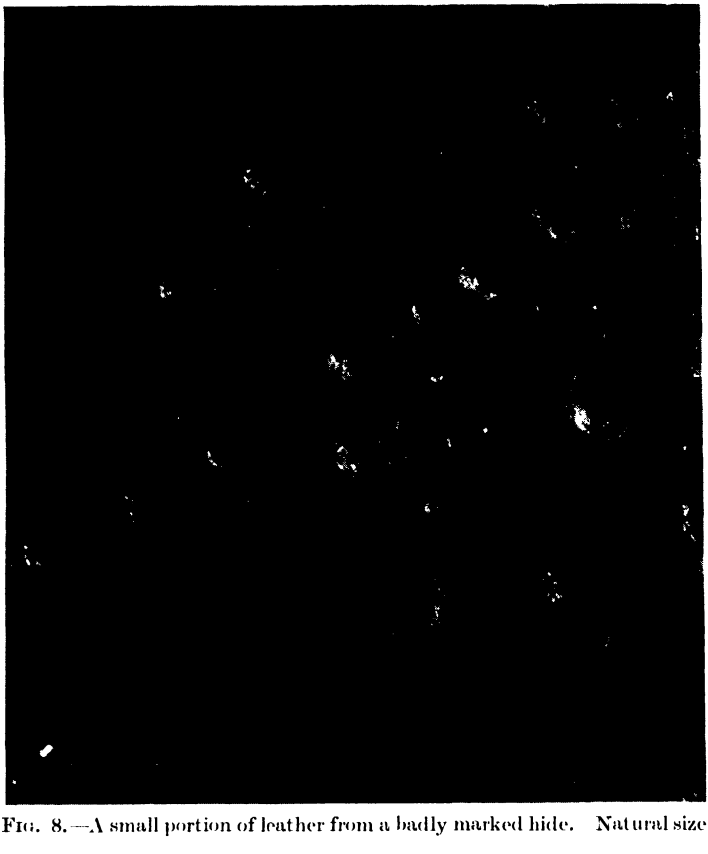

Fig. 8.—A small portion of leather from a badly marked hide. Natural size.

attachment being aided by a sticky secretion. *H. lineatum* lays several eggs on the same hair, *H. bovis* only one egg to a hair and well down. While the legs are favourite places for the laying of eggs, a number of other places on the body may be used (Fig. 2). The running animal may be followed up by the fly seeking to lay her eggs or, as happens with *H. lineatum*, the fly may land on the ground near a recumbent animal, back towards the animal, and then attach the eggs to conveniently reached hairs by means of her extended ovipositor. By a week the tiny larva has hatched out and, making its way to the base of the hair, pierces the skin and begins its wandering in the tissues. The newly hatched larva (Fig. 3) is spiny and has cutting mouth-hooks. From the place of entry the migrating larva makes its way, by the aid of a digestive ferment, to the back, spending on the way a considerable time in the gullet. In the early part of the year as many as 34 larvæ of *H. lineatum* have been taken from a single gullet. The road by which *H. bovis* travels is still a secret to be extorted from nature. From the gullet the larvæ pass to the back. A hole, which is gradually enlarged, is made through the skin to the outside. Before the skin is perforated the presence of the larva is indicated by a small sensitive swelling, in the centre of which is a red dot or " blood-spot." The larva, in its last stages under the skin, ceases to move about, becomes altered in shape and colour, and attains the form so well known to the farmer (Fig. 4). The tissues of the host animal react to the presence of these sedentary larvæ and a cyst is formed round the larva (Fig. 5). In this chamber or cyst the larva completes its growth, feeding now on pus resulting from the inflammatory secretion due to its muscular movements and also to organisms that may have entered from the outside. The larva lies in the cyst horizontally with the hard hind spiracles or breathing organs applied to the hole in the skin for the intake of air. During migration from the place of entry in the skin to the back, the larva takes the line of least resistance, viz., the softer connective tissues. The path from gullet to back is more or less direct, by the diaphragm, or ribs, or by way of the spinal canal.

The great majority of the warbles are found in the region along the back, from just behind the shoulder to the hook-bone, in two strips, eight or nine inches broad. These strips begin from two to three inches on each side of the middle line of the back or backbone and extend laterally for seven to eight inches. This is the region where the larvæ, naturally, are most likely to escape crushing. Some warbles, however, are found behind the hook-bones, on the rump and down the flanks, and others in front of the shoulders. In cows or cattle in good condition, one may find warbles well down the ribs on each side, and they occasionally occur right in the middle line above the spinal cord.

The full-grown larva, with tough outer covering and bands of spines, presses itself out of the opening in the skin—an act requiring considerable muscular effort—and drops to the ground, where it takes cover from the light, under litter or in the surface layers of the soil. In such a shelter-place the larva, after a short quiescent stage, moults. The moulted skin, becoming hard and black, remains as a protecting case or puparium under cover of which the fly develops. When ready, in five or six weeks, the fly comes from the puparium and appears in the open. The wings slowly expand, the other parts dry and harden. The fly may mate the same day. Fig. 6 gives, in graphic form, the life cycle, and Fig. 7 is a calendar for the year's round of *H. lineatum.*

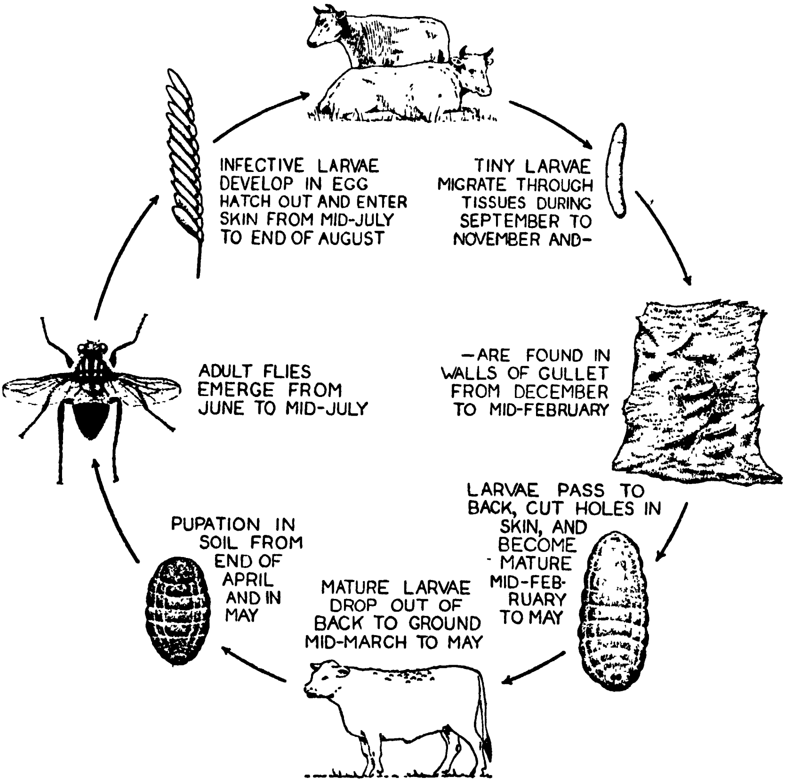
INFECTIVE LARVAE DEVELOP IN EGG HATCH OUT AND ENTER SKIN FROM MID-JULY TO END OF AUGUST
TINY LARVAE MIGRATE THROUGH TISSUES DURING SEPTEMBER TO NOVEMBER AND-
-ARE FOUND IN WALLS OF GULLET FROM DECEMBER TO MID-FEBRUARY
LARVAE PASS TO BACK, CUT HOLES IN SKIN, AND BECOME MATURE MID-FEBRUARY TO MAY
MATURE LARVAE DROP OUT OF BACK TO GROUND MID-MARCH TO MAY
PUPATION IN SOIL FROM END OF APRIL AND IN MAY
ADULT FLIES EMERGE FROM JUNE TO MID-JULY

FIG. 6.—Life cycle of *Hypoderma lineatum.*

The larvæ of both *H. lineatum* and *H. bovis* are common in Scotland from north to south, and this is not to be wondered at because of the purchase and introduction of animals from different parts of the country. While the fly of *H. lineatum* appears earlier than that of *H. bovis*, the flight periods of the two flies overlap and there is some variation of these periods.

**Harm and Loss due to Warble Flies.**—There is loss of condition due to animals gadding. The quality and quantity of milk is affected by excitement and over-exertion. Some pain is attendant on the boring into the skin of newly hatched larvæ. Condition suffers from the presence of a number of larvæ in the sub-dermal tissues. Tenderness of back is attested by the way in which the animals resent interference when the number of warbles is large. The entry to the swelling of bacteria from the outside sets up abscesses that mean unthriftiness.

The seller loses by the absence of competition in the sale-ring when an animal is noticeably warbled. There is great loss in the case of warbled hides; this may amount to 6s. or more in the case of a heavy hide. There is loss due to the spoiling of hides for tanning purposes (Fig. 8). Even when holes made by warble-fly larvæ have had time to heal after the escape of the larva, the leather made from a hide so affected shows pitting or spotting easily recognisable and it cannot be used for the finest work. A markedly lower price is paid for such leather and there are drawbacks to its use, for example, for belting, where it breaks at a lower strain, or for shoemaking, where the soles are not so waterproof.

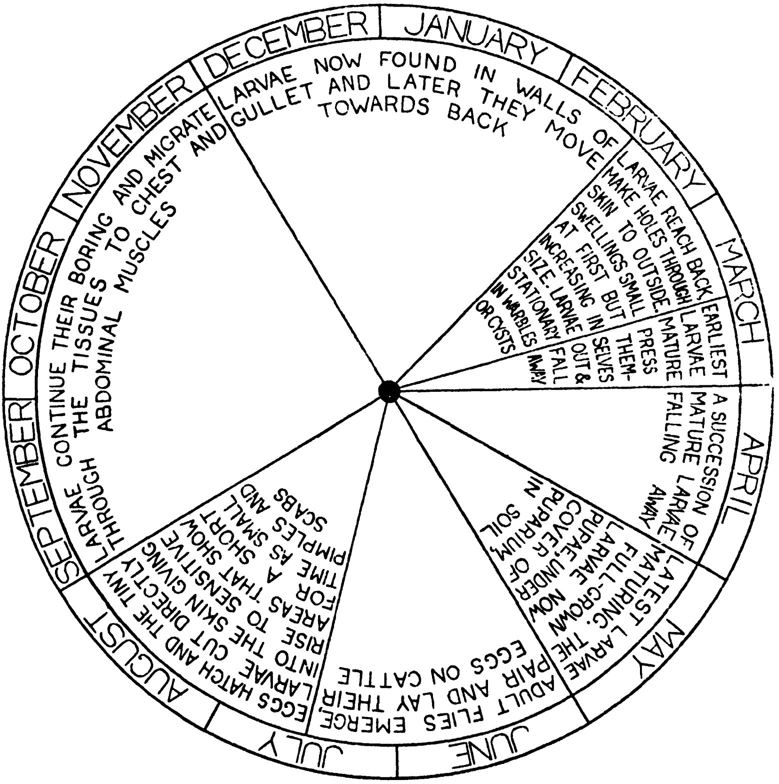
DECEMBER
JANUARY
LARVAE NOW FOUND IN WALLS OF GULLET AND LATER THEY MOVE TOWARDS BACK
FEBRUARY
LARVAE REACH BACK, MAKE HOLES THROUGH SKIN TO OUTSIDE. SWELLINGS SMALL AT FIRST BUT INCREASING IN SIZE. LARVAE STATIONARY IN WARBLES OR CYSTS
MARCH
EARLIEST LARVAE MATURE PRESS THEMSELVES OUT & FALL AWAY
APRIL
A SUCCESSION OF MATURE LARVAE FALLING AWAY
MAY
LATEST LARVAE MATURING. THE FULL-GROWN LARVAE NOW PUPATE UNDER COVER OF PUPARIUM IN SOIL
JUNE
ADULT FLIES EMERGE PAIR AND LAY THEIR EGGS ON CATTLE
JULY
EGGS HATCH AND THE TINY LARVAE CUT DIRECTLY INTO THE SKIN GIVING RISE TO SENSITIVE AREAS FOR A SHORT TIME AS SMALL PIMPLES AND SCABS
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
LARVAE CONTINUE THEIR BORING AND MIGRATE THROUGH THE TISSUES TO CHEST AND ABDOMINAL MUSCLES

FIG. 7—Calendar of the round of the year, for *Hypoderma lineatum*.

There is serious loss to the butcher from what is known as "licked beef," due to wastage in dressing the carcase of a warbled animal. Where warble larvæ have been present the back, on removal of the hide, shows a mass of straw-coloured jelly-like matter, known as "butcher's jelly." When this has been scraped away the back of the sirloin is left almost bare and its value is greatly reduced. Such beef is very difficult to mature and it displeases the eye of the customer owing to its greenish tinge. An authority has estimated that the loss thus caused may amount to a halfpenny a pound over the whole carcase.

**Control.** *Shelter.*—Cattle attacked by warble flies seek shade. It has been found that protection and relief have been obtained where it was possible to give harassed animals access to barns or sheds. Further, the flies will not follow cattle over water.

*Repellents.*—Experiments have been carried out at home and abroad with a large number of oils and emulsions as dressings whose odour or nature would disgust the fly or prevent her from laying her eggs. Both in England and Scotland such tests were made on behalf of the Departmental Committee on the Warble Fly Pest.[1] Nothing practicable can however be recommended as a result of these investigations. A considerable amount of experimental work has been done in America in the endeavour to secure a machine or sprayer which would effectively apply a spray or wash to animals for the purpose of killing or repelling flies. Experiments have also been made, chiefly in the United States, in which, during the egg-laying season of the flies, cattle have been made to pass repeatedly at regular intervals through wading vats containing arsenical or creosote preparations. The purpose was to reduce the percentage of eggs laid and to kill the newly hatched larvæ. Nothing practically useful can, however, be declared.

*Removal of the Larvæ.*—Squeezing out the larvæ as they lie in their last stage in the swellings on the back is an excellent annihilative measure. There are instances where in isolated areas this method has resulted in complete eradication of the pest. The squeezing out is done by means of the thumb and forefinger of both hands. The work though tedious is not difficult with animals that have loose, slack or elastic skins and are restful, but is more difficult with other conditions of hide and with restless animals. A special hand suction-pump has had some success in the removal of larvæ from the warbles.

*Destruction of Larvæ by Dressing.*—The larvæ in the back may be dressed with some substance which will kill them and so prevent a new generation of flies and a fresh laying of eggs. Such a dressing, to be practicable, must kill a very high proportion of the treated larvæ, must be easy to prepare and to apply, must be harmless to the animal treated and to the worker on repeated use, and must be cheap. Both at home and abroad hundreds of different substances for dressing the larvæ have been tested in experiment. The Departmental Committee referred to had considerable success with tobacco powder and lime, with nicotine sulphate and lime, and with a Derris preparation.[1] The work with Derris was pioneer work. With 1 oz. of Derris powder to a quart of water, 378 warble larvæ were killed out of 440, *i.e.* 85 per cent, and with 1 oz. of Derris powder to a pint of water 581 larvæ were killed out of 614, *i.e.* 94 per cent. Bishopp and his colleagues in the United States thoroughly tested and proved the value of Derris extracts in many experiments and very successful results were obtained by Mr R. C. Gant in experiments against warble fly larvæ in Worcestershire in 1928 and 1929. Still later, very extensive experiments in England and Scotland under the auspices of the Leather-sellers' Company's Warble Fly Committee and the Highland and Agricultural Society of Scotland proved beyond all doubt that in trustworthy Derris preparations the farmer had to hand a highly satisfactory treatment against warble fly larvæ in their cysts or swellings.

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[1] Report of the Departmental Committee on Warble Fly Pest, 1926. H.M.S.O.

In the course of experiments carried out in nearly every county in Scotland, in which many thousands of warble fly larvæ were dressed and a little later examined for results, the most successful treatment was with Polvo Powder Soap Wash.[2] The formula for this dressing is :—

| | |
|---|---|
| Derris Powder . . . . | 1 lb. |
| Soft Soap . . . . . | $\frac{1}{4}$ lb. |
| Water . . . . . . | 1 gallon |

The method of preparation is as follows : Dissolve the soft soap in a quart of boiling water and allow to cool. It is important that the cooling be to blood heat at any rate, for if the soap solution be used too hot when poured on to the Polvo powder (*i.e.* the Derris powder), the active insecticidal principle of the Derris may be adversely affected. Place the Polvo powder in a bucket, pour the cool soft-soap solution over it and stir thoroughly, bringing the quantity gradually up to a gallon by the addition of cold water. Use the dressing freshly made and while using keep the fluid agitated so that the Polvo powder may remain in suspension.

The worker feels with his fingers for the lumps or swellings, not all of which are plainly visible, and then, pulling aside any matted hair and clearing away the scab which so often clogs entry to the larvæ, applies the dressing. The dressing may be applied with a stout syringe the nozzle of which is just large enough to gain entry to the hole leading into the cyst where the larva lies. The syringe must be a stout one and not a delicate hypodermic syringe. In some cases, the workers used successfully a motor-cycle grease gun of the pump type, having a nozzle about $\frac{3}{16}$ inch in size. The syringe method is an accurate way of ensuring the entry to the cyst of the dressing fluid, but almost as good results attended the use of a cloth. The cloth is first dipped in the liquid dressing and then pressed hard on the hide over the hole in the skin, a slight rotatory or spiral movement being given at the same time. The rotatory movement exposes the warble hole by removing any block or scab resulting from matted hair or dried exudate that may have formed over the entrance hole. Pressure on the cloth causes the dressing to gain entry. The larvæ killed by the dressing will, for the most part, be later expelled by the animal or absorbed.

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[1] See note, p. 214, and *Scot. Jour. Agric.*, vol. vii., p. 61 (Jan. 1924).

[2] This is a proprietary preparation.

As explained earlier, and as a glance at the Calendar (Fig. 7) will show, warble fly larvæ reach maturity over a period of some months, so that examination for dressing on any one day may reveal differences in size of hole corresponding to the stage of development of the underlying maggot. The hole gradually increases in size. At one time of dressing some holes may be too small to justify treatment, whereas the same hole ten days later may be quite conspicuous.

*Number of Times for Dressings.*—In any campaign against warble fly larvæ the number of times of dressing is a matter of great importance. The Departmental Committee recommended four dressings against the larvæ in their warbles or cysts. The experience of the Highland and Agricultural Society's Committee and of the Leather-sellers' Company's Committee supports this view. To make sure, however, of the destruction of the very earliest ripe larvæ five dressings might be safer. Unfortunately there are two flies, those of *H. lineatum* being earlier and those of *H. bovis* later, and this extends the period in which one may expect to find larvæ. In various parts of Scotland warbles can be very noticeable by the end of February and there are records from the south of Scotland of mature larvæ falling away in the third week of March. It would be wise to undertake the first dressing in the third week of March, followed by three other dressings at intervals of about a month.

One can scarcely expect a more efficient and cheap dressing than that described above, but it would be an advantage if a Derris dressing or wash equally reliable and efficient were available requiring only dilution before use and forming a lather on rubbing so that individual treatment of each warble would not be necessary. In the experiments carried out in Scotland a warble fly powder, in which the Derris was already incorporated with the soap and only water was needed before use, seemed promising. The dressing lathered up freely on rubbing, the workers liked it and it gave the hide rather a fresh appearance. Unfortunately the results were unequal. In the United States and on the continent of Europe many successful experiments have been made with Derris preparations.

"Derris," an extract from the roots of certain East Indian plants, contains several insecticidal principles, the most valuable of which is rotenone. Derris as an insecticide is of proved value not only against a number of animal parasites but also against insects injurious to plants.

*Ointments to Kill the Larvæ.*—Derris ointment, or iodoform, or pyrethrum, with vaseline or some kind of oil have been used successfully to destroy larvæ as they lie in the cysts with their breathing pores near or pressed against the hole in the skin. The ointment plugs the larval spiracles and suffocation follows. An ointment, compared with other dressings, has a somewhat limited use. If used later in the season when long hairs have been shed and time can be spared for the thoroughness necessary for success, good results can be obtained. An ointment with the formula 1 oz. iodoform to five of vaseline, as used in the United States, is successful in killing the warble larvæ, but the odour is such that when the ointment is applied to cows in milk there is great risk of the milk being tainted.

**Compulsory Legislation.**—It is safe to say that while from time to time there has been sporadic interest and even a certain amount of agitation regarding the warble fly pest, the interest in this country has never been greater or so general than at present. The butcher, the hide merchant, the leather-seller and the tanner have long had a proved case. It is hard that the tanner should have to go to Scandinavia to buy hides because the home ones are warbled. The farmer holds, as he has always held, the key to the solution of the problem. So far he is not apparently convinced that he bears a considerable share of the loss due to warble flies. Opinion has, however, been changing and there is now considerable amount of support for the proposal of some form of administrative action. Compulsion is an unpleasant word and legislation by which a farmer would be compelled to treat his cattle for warble—as by law is the case in Denmark, Germany, Sweden and Russia—would seem hard to many farmers and stockowners in these difficult times, yet the long view may be the wise one. Examination and treatment of cattle would certainly be onerous for two or three years, but it would become less burdensome with the progressive reduction, and in some cases the annihilation, of the pest.

In July 1934, at a meeting of the Regulations Sub-Committee of the Leather-sellers' Company's Committee, the following resolutions were drawn up for transmission to the Ministry of Agriculture :

**1. In view of the consensus of opinion of all interested parties that it is urgently desirable that the universal dressing of cattle against the warble fly pest should be undertaken, and that suitable action should also be taken to deal with imported cattle, the Leather-sellers' Company's Warble Fly Committee, representative of all parties concerned, urges that the Minister of Agriculture should without delay consider the administrative problems involved and the means to overcome them.**

**2. The Committee further strongly urges that in any long-term scheme for the reorganisation of the cattle industry in this country the opportunity should be taken to deal in a comprehensive**

manner with the warble fly problem. In the opinion of the Committee no reorganisation of the cattle industry would be satisfactory which did not put into operation machinery which would lead to the ultimate elimination of the pest from this country.

The following are some of the difficulties in the way:

(1) It is not easy to prove to the farmer that the presence of a small number of larvæ affects the production of beef or milk. The animal with a small number of warbles gives no evident sign of discomfort. The few of to-day may, however, be the many of to-morrow. Besides, the presence of only four warbles reduces a first-class hide to a lower category with consequent money loss; with over four warbles the hide is placed in the second class.

(2) The treatment has to be undertaken at a busy season of the year. From mid-March to the end of May all arable farmers are busy with sowing and planting, and extra long hours are being worked. Some would find it difficult to give precedence to warble-dressing. Admittedly the work of dressing would be onerous at the beginning, but if the treatment were general it would become light and easy in time. To ensure this it would need to be general.

(3) It is naturally disheartening to keep treating animals that have become warble-infested elsewhere.

(4) The dressing of store cattle is sometimes out of favour as this involves disturbing the fattening animals when it is desirable that there should be as little excitement as possible. There would be little difficulty with dairy cattle, which are accustomed to being handled and collected, or with special herds. But in many parts of Scotland, where cattle are put out from May to October, it would be difficult to ensure the thoroughness of a third or fourth collection for the purpose of examining and dressing them.

# THE COMBINE HARVESTER-THRESHER IN EAST LOTHIAN

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Combine harvester-threshers are by no means a modern development. As far back as 1828, the first harvester-thresher was registered in the United States of America Patent Office, although the period of real development began in California a little over sixty years ago. For fifty years after its inception the development was confined to the Pacific Coast, this regional restriction being due partly to the nature of the machine and partly to the generally accepted view that its sphere of successful application was solely in areas having a dry climate and that a rainless harvesting season was essential. As a result of this view, the harvester-thresher was introduced at an early date into Australia, where it was extensively used.

The early machines cut a swath of from 16 to 40 feet and required a crew of five men and as many as thirty-six to forty horses or mules. They were operated by a ground wheel, the grain being sacked, dumped on the ground and picked up later. The introduction of the auxiliary internal-combustion engine gave rise to great developments.

It is only within comparatively recent years that the use of the combine harvester-thresher, more familiarly known as the combine, has spread rapidly in the United States of America and in Australia as well as extending to the other principal grain-growing countries. In 1928 two machines were imported into England and during that year they together harvested 289 acres. The number of machines used here has steadily increased and in 1932 twenty-two combines harvested some 4,000 acres in Britain, an average of about 200 acres each. In that year Viscount Traprain of Whittingehame purchased a 12-feet combine manufactured in England—the first of its kind in Scotland. This was the key machine of a system of mechanised grain-growing to be practised on Cairndinnis Farm in East Lothian, and in the year of its purchase, some 109 acres of grain were successfully harvested. In November 1932 Whittingehame Mains Farm was taken over by the owner, Lord Traprain, and included in his grain-growing scheme.

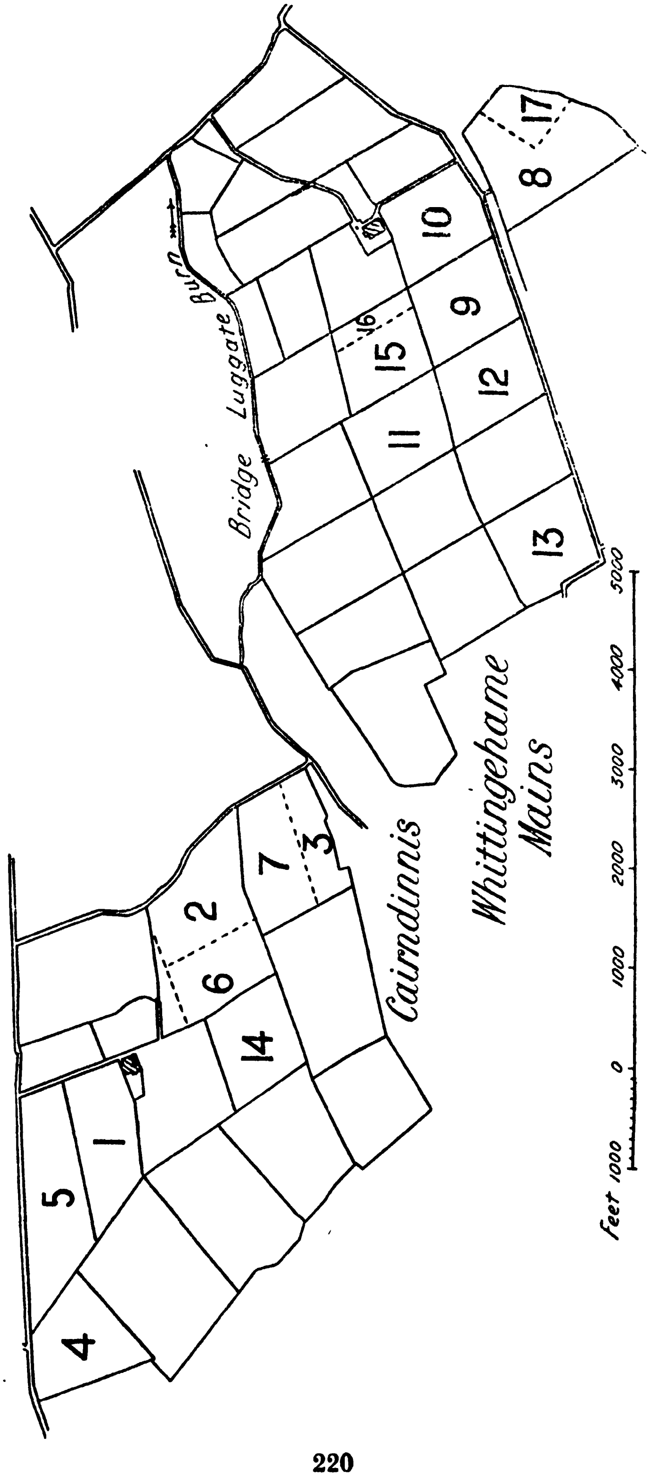
Cairndinnis and Whittingehame Mains Farms lie about five miles east of Haddington, East Lothian, and together contain some 863 acres. They lie between 200 and 400 feet above sea level and their soil varies from a free to a stiff loam. The plan shows the relative positions of the farms and the shapes of the fields. The average monthly rainfall, as recorded at North Berwick Reservoir, which lies about seven miles distant, is 3·31 inches in August and 2·33 inches in September, while the rainfall recorded on the farms during the 1933 harvest was approximately the same as at North Berwick for the same period.

The rotation adopted is three cereal crops and one fallow. No land was fallowed in 1932 or 1933, but some 68 acres fell to be fallowed in 1934. The main cereal crop is wheat, barley being secondary; a few acres of oats are grown. No farmyard manure is applied; the stubble is partly burned and partly ploughed in. The table on p. 225 shows the varieties of grain sown and the kinds of artificial manure applied. The grazings, cattle courts and dwelling-houses on the farms are let.

The staff consists of a farm manager and two permanent men. At seeding time two additional men are employed and during harvest fourteen additional men.

The acreages allocated to the various crops are as follows:—

| | Wheat | Barley | Oats | Fallow | Total |
|---|---|---|---|---|---|
| 1932 . . | 57 | 52 | 3 | 0 | 112 |
| 1933 . . | 251 | 40 | 2½ | 0 | 293½ |


Bridge
Luggate Burn
Cairndinnis
Whittingehame Mains
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Feet 1000
0
1000
2000
3000
4000
5000

The principal equipment for the two farms is as follows :—

2 Caterpillar tractors, " Ten " and " Fifteen."
1 Marshall-Diesel tractor, 18/30 h.p.
2 Two/three-furrow mouldboard ploughs.
1 Four-furrow mouldboard plough.
1 Five-furrow disc plough.
1 Tractor cultivator.
1 Tandem disc harrow.
1 Set Cambridge rollers.
1 Set spike harrows (20 feet).
1 Grain drill (28 rows).
1 Combine harvester-thresher (12 feet).
2 Manure distributors.
2 Ford 1-ton lorries.
1 Straw baling press.
1 Old car 27 h.p.
2 Straw sweeps.
2 Grain-drying plants.

The total approximate cost of the above equipment was £2,255.

**The Combine.**—In general the combine resembles a portable thresher with the addition of a 12-feet binder platform, reel and canvases. The power unit, a four-cylinder 35 horse-power petrol engine, mounted at the front end of the machine, drives the combine through a clutch and belt. The manufacturers estimate the fuel consumption to be 1·2 to 2 gallons per hour, according to the condition and bulk of the crop. The total weight is about 5½ tons. During the harvest the combine was drawn by the " Fifteen " caterpillar tractor at approximately 2 miles per hour in bottom gear. The maximum drawbar horse-power of the tractor in this gear is 20. This was sufficient for the gradients and crops met with on both farms. Towards the end of the harvest a Marshall-Diesel tractor was purchased and pulled the combine successfully. With a little practice it was found possible to cut square corners as well with the wheel tractor as with the track-laying tractor.

The cutting mechanism employed is the serrated edge type, which does not require resharpening. The knives supplied with the combine had cut some 400 acres at the end of the 1933 harvest and appeared to be capable of cutting many more. The cutter-bar and platform are of the articulated counter-balance type. The length of the stubble is controlled from the operator's platform. The cut grain is carried by canvases to the feeder house and fed head first into the threshing drum, which is of the standard English pattern, 33 inches wide and 22 inches in diameter. A smaller drum, running at a slower speed, is fitted in front of the main drum to hold and retard the grain and promote a regular feed into the machine. The grain is separated out against an adjustable concave, falls through it and thence is lifted directly to the first dressing apparatus. The straw with the remaining grain is delivered on to four cranked straw shakers which separate the remainder of the grain and deliver the straw in a ribbon at the rear. All the grain separated from the straw falls through the shaker bars on to an oscillating pan extending the total width of the machine, which conveys the grain to the first dressing apparatus. The first dressing riddles have a large surface area to remove efficiently the short straw and chaff. The separation is assisted by a carefully adjusted blast of a fan directed on to the riddles.

After passing through the first dressing riddles, the grain is elevated to the barley awner. Slides and doors allow a variation in treatment. From here the grain is delivered on to an oscillating adjustable riddle where it meets a blast from the second dresser fan, which separates short straw, thistle heads, chaff, etc. The lighter material is carried oyer to the shaker boxes and the heavier material is conveyed across the machine by an augur, elevated and passed into a bag or side-tracked into the feeder house for rethreshing. The grain drops from the adjustable riddle on to a plain round-hole riddle. Too small a riddle will result in threshed grain passing back into the augur and being rethreshed. The cumulative effect will be that threshed grain is continuously passing round and round the machine, eventually choking the riddles, and considerable loss of grain will occur. A sand riddle fitted at the base of the second dresser extracts small weed seeds, etc., which are picked up by an augur and delivered into a bag at the side of the machine. The grain is conveyed by an augur to an elevator and thence delivered to an adjustable rotary screen from which the graded grain is collected in two-bushel bags and dumped on the ground in groups of four. The bags are collected by two men with a one-ton motor lorry and conveyed to the receiving hopper of the drying plant of the farm.

**Harvesting Operations.**—Harvesting with the combine commenced in Field 1 about 3 p.m. on the 4th and terminated in Field 17 on the 28th of August, some 291 acres being harvested in 16½ days, an average of 17½ acres per day. No serious delay occurred through adverse weather conditions, but unripe wheat caused a long delay after Field 15 had been harvested. During the first 23 days of August 0·72 inch of rain fell, mostly during the night, but did little to retard the start of the combine in the mornings. The crop yields varied widely but the combine handled successfully tall and short straw crops and small tangled and weedy patches. The tangled patches were tackled by slowing down the speed of the tractor, reducing the width of swath cut and keeping the cutter-bar close to the ground.

It is essential that irregularities in the running of the combine be detected in the initial stages and corrected immediately. Stoppages during the harvest were mainly due to minor causes, such as chaff and dust collecting on the combine engine radiator, causing it to overheat, chopped weeds accumulating on the riddles, the main belt running out of alignment or the overloading of the drum. It appeared that the framework of the combine was subjected to sudden heavy stresses when the machine was drawn across open furrows, causing bolts and rivets to loosen.

Very little grain was lost by being blown out from the first dressing apparatus and the straw showed no sign of unthreshed grain. The most important loss of grain in the field appeared to be due to the knife missing bent heads and short-strawed corn when avoiding weedy undergrowth.

In the lighter crops the reel tended to carry round heads of grain and deposit them on the ground in front of the cutter-bar. This fault could have been corrected, but the time required to adjust the position and rim speed of the reel would have been considerable.

**Grain-Drying Plant.**—The grain-drying plant consists of a power unit, furnace, fan, drying chamber, grain hoppers, elevators and grain dresser. Each farm is equipped with a complete drying plant. Both plants were constructed by estate labour on the farms and they cost approximately £100 to £120 each, excluding the power unit and dressing apparatus. The grain is dried in batches. The drying plant at Cairndinnis deals with some 16 cwt. of grain per batch and that at Whittingehame Mains with some 21 cwt. per batch. A 6 h.p. electric motor is used at Cairndinnis and a 27 h.p. Tangye paraffin engine at Whittingehame Mains. Sulphur-free coke is burned in the furnace, which in each case is a simple fireclay brick structure, and air is drawn over it by a fan and blown into the central space of the drying chamber. From here the air filters on each side through vertical layers of grain about 6 inches thick, contained within thin perforated zinc sheets, into the drying room. The zinc sheets are connected by means of soldered spot joints and supported outside and inside by open rectangular wooden frames, the ends being closed by the wooden walls of the drying chamber, whilst the entrance and exits from the grain chambers are controlled by shutters. The warm air passing through the layers of grain evaporates moisture and is cooled, and the moisture condenses on the outer zinc walls. The rate of evaporation decreases in time and the temperature of the issuing air increases, causing the re-evaporation of the moisture condensed on the outer walls ; usually the moisture disappears lastly from the lowest parts of the zinc walls. When this occurs the grain is generally considered to be dry enough for keeping purposes. At this point the furnace is shut off from the fan and cold air is blown through the grain until it has been cooled sufficiently. The upper hopper shutters are then closed and the grain is run out into a receiving hopper, thence raised by elevator to the dressing apparatus, sacked and placed untied in the granary. Each drying plant is operated by three men.

A large number of observations were taken during the drying operations from which the following figures were obtained :—

| | Cairndinnis Plant | | Whittingehame Mains Plant | |
|---|---|---|---|---|
| Average moisture content of grain before drying . . | 17·78% | | 18·59% | |
| Average moisture content of grain after drying . . | 14·03% | | 14·46% | |
| Average time taken to dry each batch . . . . . | 33 min. | | 22 min. | |
| Average time taken to cool each batch . . . . . | 25 min. | | 19 min. | |
| Average temperature of air entering the central space of the drier : | Warm | Cool | Warm | Cool |
| Barley . . . | 142° F. | 81° F. | .. | .. |
| Wheat . . . | 143° F. | 70° F. | 156° F. | 82° F. |

The gross electric current consumed per batch at Cairndinnis was 3·84 units, and the gross consumption of coke per batch was 38 lb.

The temperature of the air entering the drier is controlled by varying the ratio of warm air to cool air drawn in by the fan. The minor stoppages at the drying plants were due generally to slipping of the fan belt, choking of the elevators, distortion of the zinc sheets, and the collecting of dust from the furnace in the central chamber. A more serious stoppage occurred at Whittingehame Mains when the riddling apparatus loosened and broke. The paraffin engine ran irregularly on several occasions.

Careful supervision on the part of the drying-plant operator is essential for obtaining satisfactory results. When an even temperature is maintained and allowance is made for drier or wetter grain being dried, as perceived by sense of touch, a careful operator can dry grain to a suitable degree without overheating.

Most of the wheat produced was sold for biscuit manufacture and proved satisfactory. One purchaser of the barley reported 94 per cent germination. In estimating the moisture content of the samples of grain, in each case 100 grammes were taken and dried in an electric oven for 14 hours at a temperature of 100° to102° C.

**Conclusion.**—This enterprise is unique in the development of agriculture in Scotland, and it is somewhat difficult to form definite conclusions as to its possible development. In the first place, the farms fell vacant at a time when it was difficult to relet them at their normal rental ; secondly, they were taken over by the landlord who was unencumbered with the possession of equipment unsuitable for the system to be practised ; lastly, the weather conditions during harvest proved to be exceptionally favourable to the success of the venture. It seems clear that, in a bad season, the rate of progress would be considerably reduced through much of the corn being laid and rain occurring during the daylight harvesting operations. Moreover, there would be serious risk of damage to the combine, especially when only one such machine was carried, which a large acreage of grain caused to be continuously in use. Successful combining is to a large extent dependent upon the operator being fully acquainted with the construction and operation of the machine and the care he takes in its management, together with intelligent tractor driving.

Since the straw on the whole has not proved worth the expense of collection and storage, the growing of short stiff-strawed varieties is desirable. If the straw were chopped on leaving the combine, the difficulties in ploughing it in would be eliminated. It is desirable to control the ripening periods as far as possible in order to avoid loss of time in moving the equipment to and from fields at a considerable distance from each other. Small fields undoubtedly cause a greater loss of time in turning corners than large fields, but the wastage is not necessarily serious, the combine taking approximately 14 seconds to turn through ninety degrees on the level.

The rapid accumulation of marketable grain during the harvest tends to strain the granary accommodation to the limit. Much of the grain was marketed immediately after being harvested and satisfactory prices were obtained.

It is possible that a less expensive and less complicated machine could be developed to harvest the grain in undressed condition, the grain being cleaned and graded after drying.

In conclusion, although it may as yet be premature to assess the real merit of this particular combine or to gauge the possibility of using combines on a large scale throughout the grain-growing districts of Eastern Scotland, there is no doubt whatever that its installation at Cairndinnis and Whittingehame Mains as an indispensable unit in the production of grain by mechanised methods has amply justified itself.

| Field | Area | Crop 1931-32 | Crop 1932-33 | Variety | Manures applied cwt. per acre | Cutting Dates August 1933 | Yield qrs. per acre |
|---|---|---|---|---|---|---|---|
| 1 | 20·1 | Wheat | Barley | Plumage | 2-No. 4 | 4th-5th | 5·4 |
| 2 | 19·94 | Wheat | Barley | Plumage | 2-No. 4 | 5th and 7th | 5·4 |
| 3 | 8·0 | Barley | Wheat | A.1 | 2-No. 4 | 7th | 3·4 |
| 4 | 19·7 | Barley | Wheat | D.S.U.W. | 2-No. 4 | 8th | 5·4 |
| 5 | 28·1 | Hay | Wheat | Chevalier | 2-S. | 8th 9th | 4·0 |
| 6 | 14·0 | Hay | Wheat | Chevalier | 2-No. 4 | 9th-10th | 3·4 |
| 7 | 19·2 | Barley | Wheat | D.S.U.W. | 2-No. 4 | 10th | 3·5 |
| 8 | 20·0 | Wheat/ Turnips | Wheat | D.S.U.W. | 2-S. | 11th-12th | 3·5 |
| 9 | 19·35 | Oats/ Potatoes | Wheat | D.S.U.W. | None | 14th-15th | 5·0 |
| 10 | 19·45 | Oats | Wheat | D.S.U.W. | None | 15th-16th | 5·0 |
| 11 | 18·8 | Lea | Wheat | D.S.U.W. | None | 16th-17th | 7·5 |
| 12 | 17·96 | Lea | Wheat | D.S.U.W. | None | 17th-18th | 6·5 |
| 13 | 20·67 | Oats | Wheat | A.1 | 2-S. | 18th-19th | 2·0 |
| 14 | 20·0 | Wheat | Wheat | A.1 | 2-No. 4 | 21st | 2·5 |
| 15 | 13·5 | Turnips | Wheat | A.1 | None | 22nd | 3·5 |
| 16 | 4·1 | Turnips | Wheat | Chevalier | None | 28th | 3·5 |
| 17 | 8·0 | Turnips | Wheat | A.1 | None | 28th | 3·5 |

No. 4 fertiliser is I.C.I. No. 4. S. fertiliser is superphosphate.
D.S.U.W. is Double Stand Up White.

# SOME OBSERVATIONS ON THE PREVENTION OF BLOW-FLY ATTACK IN SHEEP

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IT is proposed to describe in this short article the methods adopted during recent years at the Institute of Animal Genetics to control loss from attack by maggot-fly in sheep. The particular circumstances under which the methods to be described were employed were not perhaps an exact parallel to those under which sheep are kept on commercial sheep farms, and the methods may not in consequence be equally applicable under all farm conditions. It is, however, felt that the results were sufficiently striking to be worth recording since, with minor modifications, they could be made use of on many low-ground farms where maggot-fly attack is severe.

**The Sheep.**—These consisted of various breeds and crosses kept for such experimental purposes as involved a study of inheritance of various wool characters—colour, fineness, kemp percentage, density, and length of wool fibres, in particular. At different times, sheep of the following breeds or crosses have been used: Blackface, Cheviot, Half-bred, Greyface, Border Leicester, Lincoln, Shetland, and various Merino crosses.

As with all sheep kept in the near vicinity of large towns, where for various reasons the concentration of sheep blow-flies, both the "Greenbottle" (*Lucilia* sp.) and the "Bluebottle" (*Calliphora* sp.), is greater than in purely rural surroundings, attack by fly was a source of continual trouble and expense throughout the summer months, and perhaps especially in July, August and September. In the years 1928 and 1929 it seemed practically impossible to control the flies. Pigs were being bred nearby under the open range system of management and were receiving considerable quantities of "brock" from hotels and institutions. The residue from this, containing as it did considerable amounts of meat refuse, provided optimum breeding conditions for the flies normally present. In effect, the fly population during these two summers was far above normal levels. During this time it was noticed that while the percentage of strikes among white-woolled sheep varied between 15 and 20, among brown-woolled sheep and especially among the pure-bred Shetlands kept at the Institute, it was less than 0·5. Only one pure-bred brown Shetland ("mourrit") ram lamb was attacked during three years, and this animal had previously been injured by fighting. So remarkable was the resistance against blow-fly shown by the Shetland sheep that special permission was obtained from the City Veterinary authorities to have ten brown Shetland ewes exempted from summer dipping in 1929. At this time 174 sheep—rams, ewes and lambs—were dipped. The object was to attempt to concentrate fly on these undipped sheep by making all the others replusive to them. The dipped sheep were dipped at intervals three times during that summer with an arsenic and sulphur dip, and on each occasion they were allowed to become quite dry before the ten brown ewes were put amongst them. None of the ten was attacked by fly during the whole summer, though on one occasion within two weeks, seven of the white-woolled *dipped* sheep were attacked—two ewes, four lambs and one Blackface adult ram (at the base of the horns).

Numerous attempts were made to define wherein lay this apparent immunity and to determine whether it could be incorporated into the white-woolled Shetlands or into cross-bred Shetlands, but without success. It does not appear to depend upon any recognisable difference in chemical composition of the wool, suint, or length or density of the fleece. It is not transmitted to the white progeny between a white-woolled ram by brown Shetland ewe (white fleece colour being dominant to the recessive brown of the Shetland), but it is possessed by brown cross-bred sheep which have been extracted from Shetlands by a white breed and subsequently mated again to a brown parent.

Our conclusion, in the meantime, is that for some reason the *brown colour* of the wool of the Shetland is unattractive to the fly, rather than that it is actively repellent.

**Dips and Dipping.**—Endeavours were made to secure a dip that might reasonably be expected to protect ewes and lambs especially from maggot-fly. Most of the standard dips upon the market were tried at one time or another, but none could be relied upon to protect the sheep for more than 10 to 14 days, and when weather conditions were favourable to the fly, most dips would not protect for more than 7 days with certainty. This is, of course, in keeping with general observation and experience : it is not intended to be a reflection upon the characters or qualities of modern dips in general. To avoid a misunderstanding in this connection, it is desirable to consider the reproductive functions of the gravid female fly. When her abdomen is replete with eggs, there comes a time when it is imperative that these shall be deposited. If a soiled and dirty sheep happens to be within her range of flight, that sheep will be selected and will be struck ; where no such sheep presents itself, another is chosen, and it may be a perfectly clean-woolled sheep or lamb which is struck on the tail-head, shoulders, or loins. It does not apparently matter to the fly whether a little dip taint remains in the wool from a previous dipping ; if the urge to lay eggs is strong enough the female fly will lay her eggs on the first sheep that she finds. With some dips, when this happens, the young maggots may be killed by contact with, or ingestion of, particles of poisonous dip deposited in the fleece and no damage is done. Protection of this kind is, however, only of short duration, and it is not possible to rely entirely upon dipping to control maggot-fly attack.

**Spraying.**—For some time systematic spraying or "jetting" had been employed in Australia, New Zealand and other countries, but, according to our information, it had not met with unqualified success. We decided, however, to utilise a method of spraying on a more intensive system than is possible where very large numbers of sheep have to be treated.

In our earlier attempts, we used a powerful jet of a weak solution of a disinfectant, directed upwards so that when the sheep passed over it, it would saturate the belly and tail regions. The sheep were driven through an ordinary "shedder," and the nozzle was placed on the ground in it, between bricks over which the sheep had to step. Strikes by fly still occurred and the nozzle was altered so that the jet was changed to a coarse spray. The method of applying the spray (from below upwards) was the same. The number of lambs struck around the tail was less, but the ewes were just as frequently struck, especially high up on the tail-head and over the shoulders. During this time only a selected number of sheep were being sprayed, so that some check could be kept on the results by comparison with those which were not sprayed.

Since the proportion of "clean strikes" (*i.e.* strikes on clean areas of wool) was nearly as high as the proportion of "dirty strikes," and since by observation we noted that flies always approached the sheep from *above*, no matter where they ultimately settled, the underneath spray was abandoned for an overhead one. We also found that the finer the spray could be made, the better protection did the sheep get and the less was the waste of the spraying fluid. Moreover, if the spray was applied in the form of very fine droplets or globules, these penetrated deeper into the fleece than when the drops were large and would not cling to the wool. Finally, we employed the finest nozzle available, which is made for horticultural spraying against insect pests ("Green-fly," etc.), and by various adjustments devised a method which, during the past two seasons (1933 and 1934, both bad fly years), has given us control of the blow-fly.

**Spraying Solutions.**—Many different kinds of repellent solutions and mixtures were tried. Some were solutions of common disinfectants as ordinarily used on farms, others were made up specially. Different strengths were used. Many of these had to be abandoned for one or another reason: thus some were too expensive for frequent use; others in ordinary strengths injured the eyes and were useless when further diluted; others had too great a content of unemulsified tar oils or acids and stained the wool; some had too much whale oil, and though giving quite satisfactory protection, caused the wool to handle greasily, and towards the end of summer resulted in particles of soot, dust and soil adhering to the fleece and making it very dirty. Those which have given the best results and which, we believe, can be relied upon to protect against strike, are those which fall into the category of "liquid fly dips," as prepared by various dip manufacturers. They must be completely soluble, must contain no solid particles which block up the fine nozzle necessary for satisfactory spraying, and must not separate out if they contain emulsified oils.

**Method of Spraying.**—It is perhaps unnecessary to describe all the steps that were taken before a satisfactory method was evolved.

The solution which we eventually used was made up in pailfuls of 2½ per cent strength (4 oz. per gallon, or 1 pint to 5 gallons). This strength was adequate for all ordinary spraying, but in exceedingly bad fly periods, especially in warm, moist or thundery weather, it might be necessary to increase it to 3½ per cent (5½ oz. per gallon). Clean cold water was used, and the solution was thoroughly stirred to ensure that the mixture was uniform.

The sheep were driven into ordinary pens and packed loosely, so that while they had room to move round no great amount of ground was visible. Any fairly powerful garden syringe that will deliver a very fine spray or mist is suitable. It may be operated by one man, or with large numbers of sheep it may be necessary to employ one of the powerful pump types of syringe, which can be clamped to the top rails of the pens ; one man then works the pump while a second manipulates the nozzle.

The best results are obtained when the fine spray is directed in a practically horizontal direction over the sheep from about the level of the operator's head, and allowed to drift across the pen over the heads and backs of the sheep on which it settles. Any endeavour to force the spray *into* the wool of each sheep results in the excess running off and being wasted. It is desirable to coat the sheep with the spray in very fine globules, until they have a somewhat "hoar-frosted" appearance.

The sheep nearest the operator move away as the spray falls on them and others replace them, so that in a very few minutes all the sheep in the pen have been covered. Under ordinary conditions, two gallons of solution are quite enough for each 100 sheep, provided the spray is fine. It takes one man about seven to ten minutes to spray each 100, not including the time taken to collect and return to pasture.

Where ewes and lambs are running together, a little care is required to ensure that lambs are not hurt in the pens, but in normal years low-ground lambs are generally quite robust enough to suffer no harm by the time the fly season begins—about the middle of June. It is perhaps desirable to point out that where very young lambs are being sprayed, fewer should be penned together, since the bigger bodies of the ewes tend to shelter the lambs from the spray, and they are not so efficiently covered when packed tightly.

On windy days, spraying should be done from the windy side of the pen, and the nozzle should be kept lower than usual.

It is remarkable how sheep, after the first time or two, get accustomed to coming in for spraying. They appear to enjoy the cooling effect of the spray over their heads, but may blink when some excess inadvertently gets into their eyes. No eye injuries resulted from the use of strengths up to 5 per cent, which is considerably stronger than is advocated.

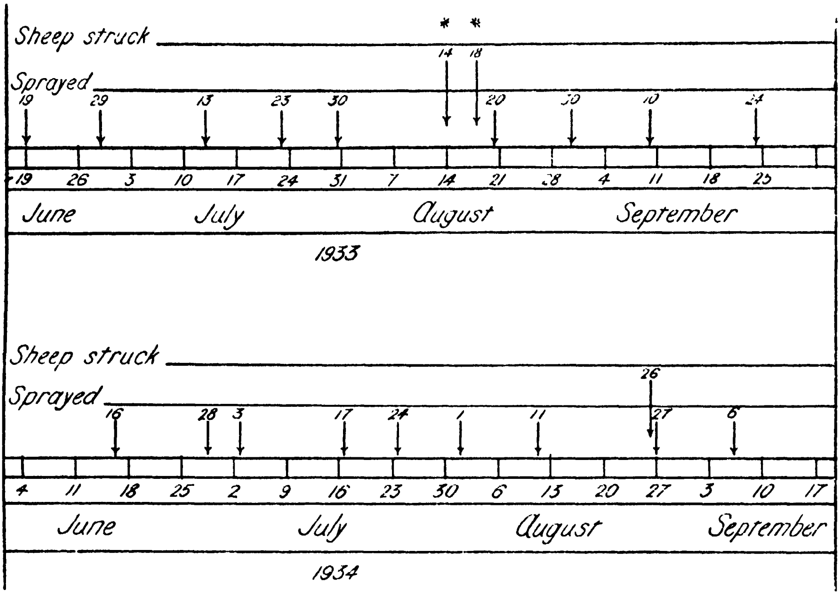

Diagram to illustrate the relationship between dates of spraying and dates when sheep were struck by maggot flies. * indicates that two sheep were struck. In 1934 on the 26th August one lamb was struck.

**Frequency of Spraying.**—Under normal conditions it is not necessary to spray oftener than once every ten to fourteen days, according to the weather and the state of the wool. In very bad fly weather and just after clipping, when the wool does not "hold" the spray so well, once a week may be necessary. When hot weather follows heavy rain, or when heavy rain falls after spraying, an extra treatment may be required.

In order to test the efficiency of the method, our sprayings were interrupted at different times during the last two years, which as mentioned, were very bad fly years. On each occasion, sheep were struck between the 15th and the 19th day after the last spraying, as shown above.

It will be noted that in 1933 there were only four cases of strike among some 220 sheep and lambs, while in 1934 among 235 sheep there was only a single case. The flock each year was kept on about 30 acres of fairly rich grassland, arranged in small paddocks of about three to five acres each. The system followed was to stock each of these heavily for a few days and then to change to another, the first being rested until its turn arrived when all had been grazed. This results in a great concentration of sheep upon a small area throughout the summer and gives greater opportunity for the flies to work than where sheep are scattered widely over a large acreage.

The author does not wish to claim any originality in the idea of spraying. The object of this article is to show that by suitable modifications, routine spraying can prevent flies from striking sheep even when these are kept under conditions favourable to the flies, provided it is carefully and conscientiously carried out.

There is no doubt that the expense and trouble involved in spraying are far less than must ordinarily be faced where sheep have to be caught and dressed almost daily. Further, the loss of condition, which is so especially pronounced when forward lambs are struck, and which is always so marked a feature of maggot attack, is avoided. The system of spraying has been successfully practised by a considerable number of sheep farmers, and it can be recommended, with confidence, to low-ground flock-owners.

# THE MANAGEMENT OF PIGS

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Success or failure in pig-farming is more closely associated with management than with any other single factor. Taking the initial stage of rearing only, it is not uncommon to find that a more efficient attendant may have an average of at least one pig per litter more reared than his less skilful confrere, even although the average number born may be no more or even slightly less. It is therefore apparent that the factor of management is of the most vital importance, as the difference in numbers reared may amount to more than the difference between a successful venture and a certain loss.

It is now generally conceded that pig-farming is most successful where the unit is self-contained and where the number of pigs kept is adequate to provide full-time employment for at least one man. With suitable housing, one man can undertake the work involved in the rearing and fattening of the progeny of 25 to 28 sows, and it is of more than passing interest to note that the returns in gross income from this type of husbandry are greater per individual than from any other branch of farming.

It is advisable in starting a pig farm to commence with maiden gilts or gilts in pig, purchased from a reliable breeder. In Scotland there is a very limited outlet for pork and a type of pig suitable only for the pork market is not therefore in favour. It is also true that selections can always be made out of pigs bred for the bacon market that are suitable for the Scottish pork trade, and where the demand exists, the pig required is one of a deadweight similar to that of the lighter weight Class I bacon pig, *i.e.* of just above 140 lb. carcase weight.

In this article it is proposed to discuss the various methods of management and their suitability for Scottish conditions. Shortage of labour during the war gave a great impetus to the outdoor method of rearing and fattening, the methods employed being :

1. *Outdoor rearing and fattening :*
    - (*a*) by self-feeders on arable land ;
    - (*b*) by self-feeders on grazing land.
2. *Outdoor rearing and fattening indoors.*

The system of outdoor rearing and fattening fell very rapidly into disuse with the return to more normal conditions after the end of the war, as this method was definitely unsuitable to the conditions north of the Border, and now the only modification of the practice in favour in parts of Scotland is that shown under the second system. The common practice is that the sows are run together during the pregnancy period and, as farrowing approaches, are drafted into single small enclosures, varying in size but generally about one-tenth of an acre in extent. Each small enclosure is provided with a wooden shelter in which the sow farrows. Farrowing may or may not be watched by the attendant, but from about three days of age the young pigs are allowed to be out of doors in all weathers. Many breeders in Scotland achieve very good results under this system, but it is not practised under the soil conditions and rainfall prevailing at Auchincruive. In a trial carried out there, the weight at weaning age of 56 days was found to be fully five pounds per head less in the case of outdoor-reared pigs as compared with those reared indoors. Under this system the pigs when weaned are penned in the fattening shed and thereafter have no exercise apart from that afforded within the pen.

The commonest system in Scotland is that under which the sow farrows indoors and the operation of farrowing is watched by the attendant. This system involves greater demands on labour, but it generally results in a more successful farrowing and subsequently in a higher number reared. This system is varied according as

(*a*) no outrun is available ;
(*b*) a run out can be given after from 3 to 7 days of age.

In the former case, greater difficulties are experienced in the rearing of the piglets from about three weeks of age, as under this method the liability to the outbreak of scour appears to be greater. Where the young pigs are given a run out daily on grass, even if only for a short period, scour does not appear. One of the strongest factors in favour of outdoor rearing is that outbreaks of this kind are unknown. The pig-keeper need not, however, be discouraged from adopting the former method of rearing, as the provision daily of a fresh turf or sod appears to overcome the difficulty. Where conditions make it possible to provide an outrun convenient to the farrowing pens, the second method should be adopted. Exercise should, however, be restricted to the minimum consistent with health, as it would appear to be false economy to provide food for growth and at the same time to permit of exercise in excess of requirement, with its consequent using up of extra food.

During the rearing period, it is essential that the young pigs should grow steadily and that the " bloom " should not be lost. The greater the weaning weight of the pigling, the more quickly will it reach bacon weight. It can almost be assumed that if the pigling does not reach a live weight of 40 lb. at weaning age of 56 days, it is impossible to make a live weight of 210 lb. at six months of age—a standard which is essential under the present scheme if an adequate margin of profit is to be made. It can further be said that for every 1 lb. under 40 lb. at weaning, the age at bacon weight will exceed six months by three days, *i.e.* a pigling of 30 lb. live weight at weaning will only reach bacon weight, on the average, at 7 months of age.

In order that young pigs may be of a good size at weaning age, it is essential that they be enticed to feed from a separate trough at the earliest possible age, and from three weeks onwards some provision of this nature is necessary. The food must not be allowed to lie long in the trough, but must be replaced at least once daily. The pigs that have been supplied with a fresh turf from about their tenth day appear to start to eat rather earlier than those which have not been given this supplement; it is therefore desirable to make this addition a standard part of the routine.

Where an infestation of internal parasites prevails—a not uncommon state of affairs—treatment should be made a regular part of the management. As administration of medicine to the pig is somewhat difficult and as internal parasites limit growth in a marked degree, treatment should be given when the pig is weaned or if purchased as a store, when purchased. Santonin is recognised as the best vermifuge but is rather costly and on this account many use a 5 per cent solution of oil of chenapodium in 95 per cent castor oil with quite satisfactory results. There are also many proprietary preparations on the market. In treatment for worms, dosing must be accompanied by a starvation period both before and after administration; it is also inadvisable during this resting period to provide bedding.

Where a regular breeding stock is maintained, an effort should be made to free the breeding stock of these parasites and afterwards to keep them free by moving to clean land at intervals before the land becomes foul and infected. This principle of rotational use of the area apportioned to the pigs is of the first importance and liming of the foul land can be safely recommended. Where the infestation is mild or absent, dosing should be avoided, as during the winter months the starvation period is frequently deleterious. The old principle of prevention being better than cure is well founded.

In the grazing of pigs, it should be noted that land of a high annual value is neither necessary nor in most cases desirable, since rougher ground provides more adequate facilities for foraging, a pastime which seems well suited to the nature of the brood sow. If highly-rented land is used, it is essential that means should be employed to prevent rooting. There is no absolutely satisfactory type of pig-ring. The only certain method of prevention appears to be the cutting of the muscle of the snout. This is rather inhuman and sows may also by this method be deprived of their ability to obtain valuable mineral elements. A piece of cut-over woodland or rough permanent pasture is admirable for the purpose of foraging and the ability of the pig to clear land of this nature is extraordinary. For the past five seasons the breeding stock at Auchincruive have been grazing and rooting in a wood, with nothing but benefit to the growing timber and with a total clearance of the undergrowth, including brambles and bracken.

Within the past few years an adaptation of the folding unit, so successfully used with poultry, has been devised for pigs. This system is becoming fairly popular in England, where its adherents claim particularly good results. It has not so far been widely tested under the more rigorous climate of Scotland, and, pending accurate trials, no dogmatic affirmation or denial of its merits in this country can be made. The method appears equally suitable for use on arable land and on pasture. The same procedure is adopted for moving as is practised with the folding units for poultry, the units being provided with wheels, skids or rockers and moved to clear their own area daily. One of the disadvantages of this system appears to be the amount of water that must be provided; it generally involves the provision of a water cart since as much as six gallons or so per day are necessary at periods for the sow and litter. If the system is used for fattening pigs, quantities considerably in excess of that indicated will be required.

A modern innovation is the practice of tethering the sow so that she can move only within a limited radius of her shelter, whilst the young pigs are allowed to roam with freedom, the shelter for the sow being moved daily on to fresh pasture. The tether is in the form of a harness round the neck and forearms of the sow and the tying attachment is from the apex of the shoulder blades. One strap passes round the neck in front of the shoulder and a second round the body behind the shoulder.

The foregoing describe briefly the systems in vogue, where use is made of grazing in pig husbandry. The experience of the College is against the adoption of any system of grazing for the fattening pig, since it appears that the exercise taken reduces the rate of growth, increases the amount of food consumed per pound of live-weight increase and lengthens the period of time taken to fatten the pig. It also appears that the introduction of a store period after weaning is definitely against the interests of the producer. The extra amount of meal involved in a short store period is certainly not great, but the mere fact of having the store period seems to slow down the pig for a time after normal feeding is resumed, and whilst ultimate progress may be great, in most cases the lost ground is not recovered.

It is not proposed in this article to discuss foods and rations suitable for breeding and fattening stock, but in pig management limitation of the daily food allowance is of paramount importance. No meal allowance should be given that is greater than the pig can readily clean up within 20 minutes, and a safe procedure to adopt is the one which has been in operation at the College Farm, first at Kilmarnock and now at Auchincruive, over a period of ten years. Briefly the procedure adopted for fattening pigs is as follows : When the pigs are weaned, they are penned and weighed and the meal allowance is calculated on the basis of 1 lb. of meal for every 28 lb. of live weight. For example, if there are 8 pigs in the pen and the total live weight of the pigs is 280 lb., the commencing daily allowance to the pen will be 10 lb. of meal. This daily allowance is increased weekly by ¼ lb. per head, so that from the commencement of the second week the daily allowance would be 12 lb., for the third week 14 lb., and so on. If, however, for any reason the pigs are unable to clear up this allowance in a reasonable time, the weekly increase is withheld. Recently this sytem has been compared at the Rowett Institute with the normal method previously in vogue there.[1] The experiment showed a saving of 91 lb. of meal per pig in the case of those on limited rations. The extra feeding period was extended by about 14 days, but this was more than offset by the higher carcase grade and the resulting higher price attained by the pigs on limited rations. It should, however, be noted that no claim is made on behalf of this system for an improvement in grade, since this is by no means a certain result of the limitation of meal allowance.

In order to economise labour in feeding, dry feeding is much to be preferred to soaking of meals. This method enables accurate rationing to be carried out more easily ; it is also more cleanly and the pig makes equal progress in comparison with any other method.

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[1] See page 273, "Aberdeen Pig Conference."

A measured quantity of water should be given after the meal is fairly well cleared up; the amount should not exceed four parts of water by weight to one of dry meal. It is now commonly stated that limitation of the water allowance is definitely beneficial in improving the belly grade under the Pigs Marketing Scheme. Experience at Auchincruive does not appear to support this view, as in carefully conducted experiments, carried out to grading stage, no marked differences between the groups were apparent, where the liquid allowance varied from three to five times the weight of meal. Live-weight progress also was uniform throughout the groups. Where, however, the intake of water is as much as five times the weight of meal, this allowance of liquid is more than the digestive organs can cope with and soiling of the bed becomes prevalent. This large allowance of liquid would therefore be very unsuitable for winter conditions.

The factors that determine grade are not as yet fully understood. In the same litter, on the same ration and even in the same pen, it is no uncommon experience to get very wide differences in the grading. Knowledge of the type of pig required in order to produce top grade will go far towards the elimination of unsuitable breeding stock and will do much to enable the pig industry of this country to put on the market a uniform product of the quality so much desired by the trade or bacon curer.

# SOME EIGHTEENTH-CENTURY SCOTTISH OPINIONS ON THE IMPORTATION OF IRISH CATTLE INTO GREAT BRITAIN

Margaret M. M'Arthur, M.A., LL.B.

Among the Breadalbane Estate Papers there is a manuscript bearing the title "Some remarks in relation to the Bill now under Consideration of Parliament for Allowing the Importation of Irish Cattle into Great Britain." The manuscript is unsigned and is dated 1758. Its calligraphy is not that of the Earl of Breadalbane (the handwriting is fairly good), but as the Earl was at that time a Representative Scottish Peer, it is probable that it was written as a speech for him to deliver in the House of Lords, where so far as can be gathered from the very scanty information contained in the House of Lords Journals, the Bill caused considerable discussion. The House went into committee on the Bill and thought of putting a question to the Judges "whether the word 'all sorts of cattle' made use of in the Bill now depending before the House, intituled 'An Act to permit the free Importation of Cattle from Ireland, for a limited time,' will in Construction of Law, Comprehend Horses, Sheep and Swine, all, any or which of them, supposing as the Law now stands, that Horses may be imported from Ireland paying a duty, and that the importation of all other Cattle from thence is now prohibited ?" According to the Journals of the House of Lords, the Bill to allow the free importation of Irish cattle for five years passed its third reading on 27th March 1759, and a message was sent to the Commons to acquaint them that the Lords had agreed to the said Bill without amendment.

The question of the importation of Irish cattle into Britain was one of great moment to Scottish landlords, writers, statesmen and economists of the eighteenth century. In the twentieth century it has again come to the fore. The Breadalbane manuscript furnishes the narrow view of the Scottish landlord, who as a Scotsman is jealous of the privilege of free trade with England gained in 1707, and as a landlord thinks of maintaining his high rents by securing high prices; the *Scots Magazine* takes a broader view and considers the general interest of all sections of the community; the great economist Adam Smith says what may be considered the final word of the period when he devotes to the subject some sixty lines of the *Wealth of Nations*, first published in 1776.[1]

The Breadalbane manuscript deals with five main points with regard to the importation of Irish cattle. It recapitulates former enactments, discusses the probable effect of the proposed Act on prices and improvements, betrays jealousy of Ireland, and with a *nota bene* draws attention to ingrossers. It is interesting to compare other contemporary Scottish opinions and to find out by a study of the economic conditions of the period how far the opinions were justified.

(1) The manuscript begins by recapitulating former Acts forbidding the importation of Irish cattle. The Acts in force when the paper was written dated from the reign of Charles II, the importation of great cattle, sheep and swine, beef, pork and bacon having then been declared *a common nuisance*, and forbidden on pain of forfeiture, one half to be given to the poor of the parish within which the goods were seized, the other half to the informer.[2] This enactment, which was temporary, was revived [3] and extended to mutton, lamb, butter and cheese, but the prohibition with regard to bacon was repealed by 5 and 6 Will. and Mary, Ch. 2. The writer of the manuscript, after noting some details concerning these and other Acts, concludes that "the great care of the Legislature to prevent the Importation of Irish Cattle into England shows the importance of it to the Nation." "The Parliament of Scotland," he continues, "found it highly necessary to make the same Prohibitions in that kingdom, by the 14 Act past 1st Sept. 2nd Ja. 7th. the Importation to Scotland of any Cattle or Horse from Ireland is Discharged under the pain of Confiscation of the Cattle and Horse, and 100 merks of penalty inflicted for each Beast upon

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[1] For a general discussion of the question of free trade with Ireland, *vide* Adam Smith's letters to Lord Carlisle and Henry Dundas, written in 1779; Rae, *Life of Adam Smith*, pp. 346-355.

[2] 18 Charles II, Ch. 2 (1666).

[3] 32 Charles II, Ch. 2 (1680).

the Importer and as much upon the Receiver. This Act is Ratified by Act of Part. 1st. Queen Ann, Anno 1703 and extended to Irish beef. The Importers if fit for soldiers are ordained to be seized and sent abroad as Recruits to Serve his majesty's allies. . . . After the Union the keeping Irish Cattle and Horse from being Imported into Scotland was Considered as a matter of such great Consequence that an officer was appointed with £1500 sterling sallary per Annum to prevent the Running and Importing of Cattle, Horses, etc., from Ireland upon the West Coast of Scotland; the office was Conferred upon Sir John Schaw of Greenock with whom it was Continued till he dyed a few years ago." In a truly conservative spirit, and all unsuspecting that there were in Scotland ideas fermenting which were going to revolutionise economic policy, the writer concludes, "If the Measure now proposed be Proper and Beneficial of Allowing the Importation of Irish Cattle, etc. into England and Scotland, the Legislature formerly must have mistaken greatly the Interests of both Nations, and in that Case it's a matter of Surprise that the mistake was not sooner Discovered in either Country."

(2) In the second place the Breadalbane manuscript discusses the probable effects of importation on prices. The scarcity of cattle and their high price were advanced as arguments in favour of free importation. The writer of the manuscript does not deny that "the prices of Cattle in Great Britain have often had their Risings and fallings occasioned by accidents or natural causes," but he asserts that "before the late Distemper amongst the Cattle in England and the Devastation in the Highlands of Scotland by the late Unnatural Rebellion, there was plenty of Cattle sufficient for the Consumpt of the United Kingdoms and the prices extremely moderate, rather low than too high, which is Demonstration that our country can well Breed and Bear as many Cattle as will sufficiently feed ourselves and as the late scarcity and high prices of Cattle have evidently been occasioned by the above causes they are no evidences to the Contrary nor does there appear any necessity for allowing the Importation of Cattle as an Interim Remedy." He points out that since "the Distemper has ceased and the Highlands of Scotland begun to Recover by the good and prudent measures of the Government in the management and application of the Rents of the Annexed forfeited estates and the Industry and Improvement thereby Introduced into the Highlands," cattle had increased so much that the English demand did not in the previous year exhaust the Scottish supply, and prices had fallen nearly a fourth lower than they had been for several years. "If," the writer contends, "Irish Cattle are allowed to be Imported it is past doubt evident that the Scots Cattle by those Importations must be reduced at least in their value one half." The *Scots Magazine* takes it for granted that the free importation of Irish cattle would cause a fall in prices. Adam Smith draws a distinction

between fat and lean cattle, explaining that the latter only could be imported from Ireland, because those parts of Great Britain bordering upon the Irish Sea being grazing counties, Irish cattle would have to be driven through them before they could reach their proper market, and "fat cattle could not be driven so far." "Thus," he says, "though the free importation of them, which was lately permitted only for a limited time, were rendered perpetual, it would have no considerable effect upon the interests of the graziers of Great Britain." He remarks upon "the small number of Irish cattle imported since their importation was permitted, together with the good price at which lean cattle still continue to sell." [1]

From an investigation of available evidence from different parts of Scotland [2] it appears that the prices of Scottish cattle did not fall as a result of the Act allowing the free importation of Irish cattle. Actual prices are not quoted in the Breadalbane manuscript, but the writer, in estimating the extent of the cattle trade between Scotland and England, puts the price of cattle "at a medium of £3 per head" and of sheep at 6s. each.[3] It does not appear that stock-books were kept on the Breadalbane Estates such as were kept on the Marchmont Estates in Berwickshire, where an inventory of the cattle on the estate was made annually on 12th November, giving particulars of each animal and the date of the sale and the price obtained were entered during the year. In the current accounts of the Breadalbane Estates, however, there are statements regarding the buying and selling of cattle and sheep, and these statements show that between 1758 and 1763 the prices of cattle and "Highland" sheep remained near the figures quoted by the writer of the manuscript, though sheep of Taymouth stock fetched always about double the price of "Highland" sheep. The Breadalbane accounts thus belie the forecast made by the writer of the Breadalbane manuscript.

Neither do the Marchmont accounts furnish evidence of a ruinous fall in prices caused by the importation of Irish cattle. Whether or not Berwickshire oxen were larger than Kincardineshire oxen, the fact remains that between 1758 and 1764 the average price of oxen on the Marchmont Estates never fell as low as £4, the price quoted in the Report to the Board of Agriculture for the County of Kincardine for the fattest oxen of 1764.[4] It does appear, however, from the Marchmont accounts that in 1759, when the Act allowing the importation of Irish cattle was passed, the prices of sheep and cattle were exceptionally high.

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[1] *Wealth of Nations*, Bk. IV, Ch. 2.

[2] Breadalbane Estate Papers—Perthshire.
Marchmont Estate Papers—Berwickshire.
Monymusk Estate Papers—Aberdeenshire.
Miscellaneous Testaments from the Commissariat of Edinburgh.

[3] The prices throughout are quoted in sterling.

[4] The Report states that prices rose gradually from 1740, when the largest ox in the country, weighing from 25 to 30 stones, could have been bought for 20s., or at most a guinea, till 1764, when "cattle of that size, and as full fed as the country could make them, brought from £3 to £4."

The average Marchmont prices for each year from 1758 to 1764 were respectively, £7, 1s. 8d.; £9; £6, 6s.; £6, 6s.; £4, 4s. 10d.; £5, 12s. 9d.; £6, 12s. 4d.

The entries in the Monymusk account books also indicate that Scottish cattle prices did not fall as a result of importation from Ireland, nor do they support the statement that in 1765 "the price of black cattle fell so suddenly and badly that the dealers in Aberdeenshire universally stopped payments."[1] There is, perhaps, evidence of a slight drop in prices in 1764, especially in the case of hides.

From a study of inventories contained in testaments of the period it appears that there was no very great fluctuation in cattle prices, the prices quoted being, as is to be expected, somewhat lower than those found in estate papers.

It may be safely concluded, then, that the writer of the Breadalbane manuscript was mistaken. The Act allowing the free importation of Irish cattle for five years did not cause a fall in prices ruinous to the Scottish cattle trade with England.

(3) As a consequence of the anticipated fall in prices, the Breadalbane manuscript predicts the putting of an end to all improvements in the Highlands of Scotland, fit only for breeding cattle. "The Benefite Arising from the Breeding of Cattle for severall years have encouraged the Highlanders to Inclose their Hills and Pasture Grounds to make them more useful and proper for that purpose, in which they have made Considerable Progress especially upon the Annexed Forfeited Estates and have just begun to find the benefite of their Industry." It is predicted that rents will be reduced by at least a quarter, which will ruin the Highland landlords while "vivers and victuall will be brought so Low that it must Reduce the Rent of the Lower part of Scotland."

The *Scots Magazine* [2] deals with this point at considerable length. Remarking that "this whole affair relating to the importations from Ireland . . . was a dispute between the trading interest and the present landed interest," the article points out that the future landed interest must in every country coincide with the trading interest. As to the present landed interest, it is argued, a free importation of provisions from Ireland would, at first, and perhaps for a considerable time, lower the rents of most of our farms, especially if it be true that rents in Ireland are lower; but if we consider the future landed interest,[3] and the general interest of the nation, it is certain that restrictions on importation to maintain high rents will cause the cost of production of manufactures to be high through high wages necessary to buy food, and consequently the falling off in exports until the home market is the only market, and even there smuggled goods will restrict the sales. Pointing out that Ireland was forced to sell to France and Holland [1] "who are our chief rivals both as to manufacture and navigation," the *Scots Magazine* advocates free importation into Britain. "So far from prohibiting the importation of provisions from Ireland we ought to encourage it as much as we can; and a perpetual law for this purpose would certainly be greater encouragement than an annual bill, as it would encourage the raising, as well as the importing, of such provisions; and would certainly make them go dearer from Ireland to every foreign market, than they can do whilst the importation of them to this kingdom continues to be on a precarious footing. Such a perpetual law might perhaps lessen the rent of some of our pasture-grounds in England that are now let at as high a rack-rent as they can possibly bear; but as an increase of our manufactures and navigation would produce an increase in all cities, boroughs, and market-towns, the rent of all our meadows, and arable grounds would probably increase; whereas the whole land-rent in England would fall, should our foreign trade be ruined, or very much diminished." [2]

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[1] W. Alexander, *Northern Rural Life in the Eighteenth Century* (1877), p. 71.

[2] March 1759.

[3] "Those gentlemen that would by a law keep out Irish cattle to advance the rents of the land, will find they mistake their own interests. There is a present good and a future good. It may possibly fall out that, for the present, they may make some advantage till the trade comes to find another course." The substance of the argument made use of in 1679 by Thomas Papillon, Esq., M.P. for Dover.—*Gentleman's Magazine*, March 1758.

Adam Smith deals more directly with the point raised in the Breadalbane Manuscript. True, in speaking of the advantages reaped by Scotland from the Union with England, he says that of all the commercial advantages derived, the "rise in the price of cattle is, perhaps, the greatest. It has not only raised the value of all highland estates, but it has perhaps been the principal cause of the improvement of the low country." [3] But in discussing the question of importation from Ireland he says "the high price of lean cattle by augmenting the value of uncultivated land, is like a bounty against improvement. . . . The mountains of Scotland, Wales and Northumberland, indeed are countries not capable of much improvement and seem destined by nature to be the breeding countries of Great Britain. The freest importation of foreign cattle could have no other effect than to hinder these breeding countries from taking advantage of the increasing population and improvement of the rest of the kingdom, from raising their price to an exorbitant height, and from laying a real tax upon all the more improved and cultivated parts of the country." [4]

(4) Scottish jealousy of the privilege of free trade with England is apparent in the contention that the anticipated fall in prices will cause the expense of driving cattle from Scotland to England "to exceed their value, and of Consequence put an end entirely to that trade and take £210,000 sterling yearly from Scotland which they

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[1] "God hath given Ireland to England. All its riches, all its commodities are ours. And what, shall we reject them and say we won't have them ? let France have them, let Holland have 'em, we will not suffer 'em to come into England."—*Gentleman's Magazine*, March 1758.

[2] 1762.

[3] *Wealth of Nations*, Bk. I, Ch. 2.

[4] *Ibid.*, Bk. IV, Ch. 2.

generally draw for their cattle from England, and give it to Ireland which is already Wallowing in Wealth without Debt and has the balance of Trade against both England and Scotland without bearing any share of their Taxes or publick expense." The number of cattle bred in Scotland is estimated in the manuscript at "about 300,000 whereof 70,000 sold to England yearly at a medium of £3 per head come to £210,000," and the number of sheep sold to England yearly at "about 80,000 valued at 6s. each" making in all £234,000. In 1751 the number of cattle driven into England annually was estimated at nearly 80,000 and of sheep at about 150,000.[1] According to the estimate of Sir John Sinclair, about 100,000 head of cattle were sent to England yearly from Scotland towards the close of the eighteenth century.[2] Far from losing her £210,000 annually, Scotland, towards the close of the century, could not cope with the increased English demand, especially if some misfortune caused scarcity of cattle in England. The winter floods of 1770-71 which destroyed the fodder, the spring frost which ruined the turnip crop, and the summer drought which damaged the hay harvest caused one writer to ask where England would have been if there had been no Scottish or Welsh cattle,[3] while Marshall remarked upon the scarcity of cattle in April 1786 when the Irish supply was detained by the east winds,[4] and stated in 1788 that if no Irish cattle arrived the Yorkshire grazing grounds would not be fully stocked.[5]

(5) After a peroration recapitulating the points already made, the writer of the Breadalbane manuscript adds, "N.B.—May not the present High price of Beef in and about London be in some measure owing to Ingrossers?" This query may perhaps be dismissed as indicating a survival of the medieval suspicion of bulls and bears as the cause of fluctuating prices. The writer earlier explained the cause of high prices as disease and rebellion. He does not suggest any method of dealing with ingrossers, but in his concluding paragraph he does suggest an alternative to the free importation of Irish cattle for five years. "Cattle in a very few years will be as plenty as ever in Britain. They are now Daily Increasing. To forward which it would appear to be a more proper measure to allow 20,000 Heifers to be Imported fitt to be immediately bred out of, than to pass the Bill allowing in Generall an Importation of Irish Cattle." The remedy suggested is not novel, for licences to import Irish cattle in order to improve the Scottish breed had in the previous century been granted by the Privy Council.[6]

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[1] Malachy Postlethwayt, *The Universal Dictionary of Trade and Commerce.*

[2] W. Alexander, *op. cit.* For a criticism of Sinclair, see G. E. Fussel, "The Size of English Cattle in the Eighteenth Century." *Agricultural History,* III, 4.

[3] John Dove, *Strictures on Agriculture* (1770).

[4] William Marshall, *The Rural Economy of the Midland Counties* (1790), II, 293.

[5] William Marshall, *The Rural Economy of Yorkshire* (1788), II, 210.

[6] For details of imports, see Alexander, *op. cit.*

The three eighteenth-century Scottish opinions which have been discussed might be taken to represent the two sides of the controversy between the landed interest and the trading interest, and the disinterested view of the economist. The fears of the landed interest have been shown to be groundless. The free importation of Irish cattle probably served to keep prices steadier than they would otherwise have been. When prices in Britain were raised by scarcity such as occurred in 1762 (when the lean stock died because a dry summer had caused shortage of fodder),[1] cattle would be exported from Ireland, but the Scottish cattle trade with England was not adversely affected.

# POTATO BLIGHT

## A NEW METHOD OF CONTROL BY CHEMICAL SPRAYING

R. K. MacDowall, Dip.R.T.C., A.M.Inst.C.E.

Potato disease or "blight" caused by the fungus *Phytophthora infestans* is generally recognised as the most serious of the potato diseases and one of the greatest sources of loss to those engaged in large-scale potato production. That the eventual remedy will come from the plant-breeder by the evolution of resistant strains is possible, but until this is accomplished great interest will continue to be taken in preventative measures.

The first sign of an attack of blight is well known to most growers. Under warm and humid weather conditions, characteristic patches develop on the haulm. On the upper surface of the leaf these are dark coloured, while on the under surface the patches are greyish-white and slightly furred. The tops die off prematurely and the shortening of the growing period reduces the yield of the crop. In addition, the fungus from the diseased haulm infects the tubers, many of which may have to be rejected at lifting. Potatoes infected at that time but not then visibly attacked, subsequently rot during storage and may, in addition, become infected with other organisms; thus serious losses may occur in the pits.

It is known that the spores of the fungus produced on the leaves may be washed down through the soil, and that the potatoes become infected during lifting by contact with the tops or with surface layers of contaminated soil. Murphy's experiments in Ireland have shown that potatoes lifted when the tops are blighted and alive, invariably develop blight during the subsequent storage. From this it is concluded that digging should take place about a fortnight after the tops are dead when the fungus has lost its virulence.

**Established Methods of Combating Blight.**—Cultural measures and the choice of the more resistant varieties are known to reduce greatly the occurrence of blight, but they cannot prevent it. Accordingly, considerable work has been done on the protection of crops by the application of fungicides during the growing period.

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[1] G. E. Fussel, *loc. cit.*

In all measures of blight control during the growing period, the object is to give the haulm a light coating of fungicide over the whole surface, so that the blight fungus cannot obtain any considerable area of unprotected leaf on which to develop. For this purpose, wet or dry spraying with a variety of materials has been employed. For application in the liquid state Bordeaux or Burgundy mixtures are most generally recommended. Many dry powders have also been used ; the basis of these is almost invariably one or other of the chemical compounds of copper.

A wet spraying is generally recognised as giving more effective protection than an application of dry powder, but the latter practice is in more general use on account of lower labour costs and the much greater ease and rapidity of application. The most effective control seems to be got by a number of light applications of fungicide to ensure that as fresh growth is made it does not go for long unprotected by a coating of fungicide.

In a season when blight is very prevalent, dry spraying is in some cases almost a weekly operation, very light dressings of fungicide below 10 lb. to the acre being used. In this way the haulm is kept in a fairly healthy and blight-free state, but the control obtained is somewhat variable. The successive applications of fungicide prolong the life of the haulm. This, although tending to increase yield, is often troublesome because it may delay lifting in a rainy autumn.

**A New Method of Control by Destroying Blighted Haulm.**—During the last two seasons an additional line of attack on blight has been developed in Lincolnshire and Norfolk, originated chiefly by Dr H. C. Brown of the West Norfolk Farmers' Manure and Chemical Co. The object in this case is not the coating of the haulm with a protective fungicide, but the rapid wilting and destruction of the blighted haulm, or where the tops are late in ripening the destruction of the healthy haulm so as not to delay the lifting of the crop. For this purpose sulphuric acid spraying is used. This is a chemical method of plant destruction which has come into favour within the last three years and is a relatively weatherproof operation for the destruction of charlock and other surface weeds in corn.

From its extreme chemical activity and fungicidal properties, sulphuric acid would appear to be a promising material for the destruction of infected vegetation. When commercial sulphuric acid is applied to weed-infested grain at a strength of 7 to 10 per cent by volume, it wilts the leaves of yellow charlock, wild radish and thistles within three to four hours, while it also destroys a large proportion of the outer leaves of the cereal.

For the destruction of diseased potato haulm the strength of the acid is considerably higher than that used in spraying grain. So far, the general practice has been to use solutions of 15 per cent, that is, 15 gallons of strong commercial acid, " B.O.V.", to 100 gallons of spray. The volume of spray to the acre is much the same as in spraying grain, about 100 gallons being applied, and no damage to shallow-lying tubers has been observed.

The action of the spray on the haulm is very rapid. Three to four hours after the application of a 15 per cent strength, marked browning and wilting occur, while the next day the haulm is completely dead. With a strength of 10 per cent the wilting is much less rapid, and the lower concentration would be more susceptible to weather interference, either by rain or dew.

Spraying is done generally when blight is confined to the haulm, while the tops are green and the crop is still making some weight. On this account it may be expected that a few hundredweights of tubers to the acre will be sacrificed. On the other hand, the chance of a loss through blight of from 25 to 50 per cent of the crop is practically eliminated.

The exact time for the destructive spraying of the haulm is therefore a matter of compromise. The operation should be delayed as long as possible while the crop is making weight, and the blight is not spreading to the potatoes, but it should not be delayed unduly so that the yield of healthy ware is seriously reduced and riddling expenses are increased.

In addition to destruction of the fungus and summer spores on the haulm, it seems probable that some cleaning of the infected surface soil occurs also, since acid spraying is known to cause a marked development of acidity in the topmost inch of all but the most calcareous soils for two to three weeks.

In addition to reducing the loss from blighted tubers, the destructive spraying of potato haulm with sulphuric acid is of value in other directions. When the haulm begins to die down naturally, a severe infestation of surface weeds, such as chickweed, frequently takes place and greatly hinders the operation of the potato-digging machines. If lifting is late, this quick-seeding weed reaches maturity and fouls the land in the future by the deposition of many seeds. Chickweed is very susceptible to acid spraying and is destroyed under dry conditions in three to four hours with solutions as low as 7 per cent in strength.

The removal of healthy haulm itself in a late season has long presented a problem to the grower. As yet no satisfactory cutting-machine has been devised which will give a moderately clean cut, and the problem of designing such a machine is not an easy one. While scything would appear to be cheaper than destructive spraying the removal of the tops has still to be done, a laborious and expensive job when the haulm is heavy and green.

Where seed potatoes are being grown and it is desirable to control the size of the tubers, further growth can be prevented by destroying the haulm with sulphuric acid, and experience indicates that the crops obtained from such seed are more healthy than those from seed selected by riddle after the natural withering of the haulm.

**Spraying Equipment and Operation.**—The equipment for spraying potato haulm is substantially similar to that used for spraying cereals with sulphuric acid for the destruction of surface weeds. In potato spraying, however, time is of more value in view of the importance of getting over all the crops quickly, and of reducing the chances of tuber infection when blight has once started on the haulm. In the early autumn too, the working day for wet spraying is shorter, owing to earlier darkness and the heavier dews.

In potato spraying, where a high concentration of acid (15 to 20 per cent) is found best, the damage done by an early evening dew can be considerable. A moderate dew will amount to some 300 gallons per acre, which may reduce the concentration of 100 gallons per acre of 20 per cent spray to 5 per cent, barely sufficient to kill even yellow charlock.

The grower can have the work done by contract or he can purchase his own spraying tackle. In the Eastern counties, where large acreages of potatoes are frequently owned individually, a great number of those who use this new method have purchased their own outfits, sometimes two or more machines.

The illustration shows the barrel of a machine being filled with water from an adjoining drain at a speed of 1,500 gallons per hour, using a double-action piston pump of the well-known trench type. At the same time strong acid is being lifted from the carboy and delivered direct to the barrel of the sprayer by means of a rubber diaphragm pump.

With an arrangement of this kind, where water adjoins the field, the time required for filling the machine with water and acid seldom exceeds seven minutes, and the idle time of the sprayer itself is reduced. All handling of acid is confined to a small suitably designed pump delivering 150 to 200 gallons hourly, enabling a cheap portable water-pump of large capacity to be used for the great bulk of the liquid sprayed. In this sprayer dilution of the strong acid with water is done under cover in the machine and a hand-worked paddle is provided for mixing the contents of the barrel when the sprayer is at rest.

A sample cock is fitted to this machine where the strength of the spray can be tested by hydrometer, obviating measurement of strong acid in pails, and generally making the preparation of a corrosive chemical spray safer.

The width covered by the jets is 16½ feet, enabling about six rows of potatoes to be sprayed. The rate of working is of course dependent on local factors such as water supply; under good conditions the machine should average some two to three acres per working hour.

**The Costs of Spraying to Destroy Haulm.**—To justify the purchase of a sprayer and a filling pump, which together will cost from £60 to £80, about seventy to ninety acres should be treated annually. Even if relatively few acres of potatoes require spraying in a blight-free season, there is other useful work the machine can do. Where Brown Mustard, *Brassica nigra,* is grown, a considerable quantity of seed is shed during harvest, and the mustard sometimes appears in subsequent corn crops as a weed, which can be eradicated by spraying with a weak solution of acid in the same way as yellow charlock.

Another less orthodox use for the sprayer is to reduce the risk of heavy grain crops lodging. Where sheep cannot be used to graze down these crops, acid spraying has proved very effective on several farms for destroying some of the leafage and strengthening the straw.

The cost of spraying varies from farm to farm according to the extent to which the machine is used, the cost of acid, and the accessibility of the water supply. On several large farms individual machines have dealt during a year with 100 acres or more, including potatoes and grain.

The following may be taken as a fairly typical example of the inclusive cost of spraying haulm with acid :—

| | Cost per acre<br>s. | <br>D. |
|---|---|---|
| *Sulphuric Acid.* | | |
| Say, £4, 5s. delivered per ton of about 130 gallons. | | |
| Applying 15 per cent, *i.e.* 15 gallons per acre . . | 10 | 0 |
| *Machine charges.* | | |
| Capital cost, say, £65. Annual depreciation and repairs, say, 20 per cent. Spraying 100 acres yearly . . | 2 | 6 |
| *Labour.* | | |
| 3 men and 3 horses. Spraying 12 acres daily . . | 2 | 3 |
| | 14 | 9 |

If the work is done by contract the contractor will charge the farmer 18s. per acre for applying acid of the same strength. In addition to this, horses and labour have to be supplied at a cost of about 2s., making a total contract cost of £1 per acre.

**Results and the Return on Spraying Expenditure.**—As with the chemical destruction of weeds such as yellow charlock in corn, the possible financial gain on spraying blighted haulm is undoubtedly very variable.

In a recent publication by the National Sulphuric Acid Association, the results are given of a field trial carried out in 1934-35 on the spraying of diseased haulm in the Eastern counties.

The following figures were obtained from the trial plots :—

| | BLOCK 1 | | | BLOCK 2 | | |
|---|---|---|---|---|---|---|
| | PLOT 1 | PLOT 2 | PLOT 3 | PLOT 4 | PLOT 5 | PLOT 6 |
| | A | C | B | A | B | C |
| | 10% Acid | Control | 20% Acid | 10% Acid | 20% Acid | Control |
| | cwt. st. lb. | cwt. st. lb. | cwt. st. lb. | cwt. st. lb. | cwt. st. lb. | cwt. st. lb. |
| TOTAL YIELD . | 17 3 7 | 19 7 8 | 17 0 8 | 14 0 11½ | 17 3 7 | 15 4 3 |
| BLIGHTS . . | 0 1 1 | 1 0 10 | 0 0 12 | 0 0 8½ | 0 0 10 | 0 3 7 |
| PER CENT BLIGHTS TO TOTAL YIELD | ·77 | 5·46 | ·63 | ·54 | ·51 | 2·82 |

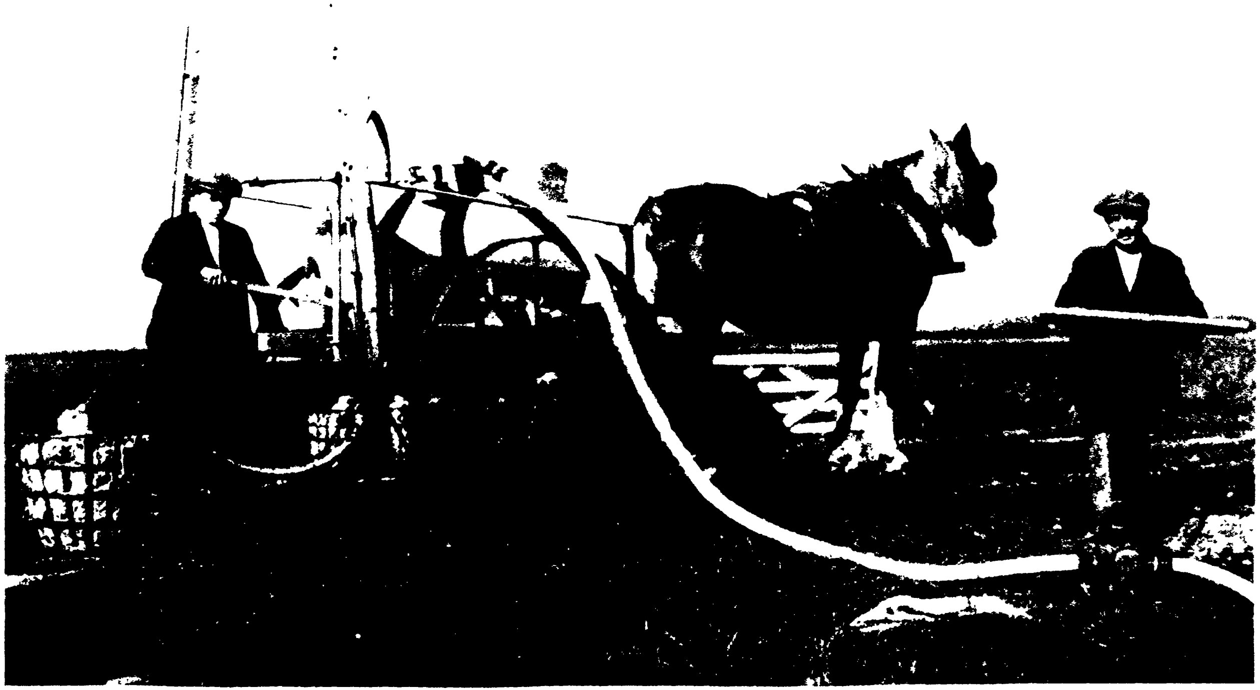
| | BLOCK 3 | | | BLOCK 4 | | |
|---|---|---|---|---|---|---|
| | PLOT 7 | PLOT 8 | PLOT 9 | PLOT 10 | PLOT 11 | PLOT 12 |
| | C | B | A | C | B | A |
| | Control | 20% Acid | 10% Acid | Control | 20% Acid | 10% Acid |
| | cwt. st. lb. | cwt. st. lb. | cwt. st. lb. | cwt. st. lb. | cwt. st. lb. | cwt. st. lb. |
| TOTAL YIELD . | 13 1 7 | 16 6 2 | 17 3 2½ | 16 1 8 | 16 4 6 | 16 6 3 |
| BLIGHTS . . | 0 2 11 | 0 0 8½ | 0 1 5 | 0 5 9 | 0 0 7 | 0 0 7 |
| PER CENT BLIGHTS TO TOTAL YIELD | 2·64 | ·45 | ·98 | 4·36 | ·38 | ·37 |

In reviewing these results it is pointed out that owing to the very dry summer of 1934 blight was but slightly in evidence, and a badly diseased crop could not be found for the purpose of the trial. In the trial the value in the loss of yield is estimated at 54s. 6d. per acre, while the cost of spraying amounted to 22s. 6d. an acre. Trials will be carried out in several areas this year, when blight may possibly be more prevalent, and results obtained showing more distinctly the value of spraying.

In addition, there is the saving in riddling expenditure which mounts rapidly with severity of the blight attack, and in the worst instances can culminate in picking over a clamp of potatoes which showed no blemish at the time of lifting. The advantage of killing off green and luxuriant haulm quickly in a late season, or a prolific growth of chickweed, is of real practical value when otherwise lifting with digging-machines would be delayed.

**Summary.**—The infection of potatoes with blight about the time of harvesting, caused by the presence of the fungus, *Phytophthora infestans*, on the haulm, can be reduced by destroying the diseased green parts with a spray containing about 15 per cent sulphuric acid (15 gallons Brown Oil of Vitriol, "B.O.V.", in 100 gallons of spray). The spray is applied at about 100 gallons to the acre, prior to lifting the crop, and the cost, using horse-drawn machines, varies from 15s. to 20s. per acre according to local conditions.

The method has also been used for rapid destruction of haulm or weeds to enable mechanical digging of the crop to proceed, and



Filling the machine with water and acid.

no damage to the tubers themselves from the corrosive spray has been observed.

The thanks of the author are due to many growers who have enabled different equipment and methods for preparing the spray to be tested, and also to Professor J. A. Scott Watson for very helpful assistance.

# SMALL-HOLDINGS IN DENMARK

## A NEW ACT

J. S. Dunbar

On 1st April last there came into force in Denmark the main provisions of a new Act of the Rigsdag giving further assistance in the formation of small-holdings. The Act is in large measure a consolidating Act, incorporating what has been found of use after thirty-five years' experience of the working of small-holding legislation. At the same time it lays down for the two years ending 31st March 1937 the limits of assistance available from the State for the acquisition of land and the erection of buildings, and the total amount the State is prepared to provide.

**Previous Legislation.**—In the seventies of last century a fundamental change took place in Danish agricultural practice. The price of grain had fallen and continued to fall, while the prices of butter and pork kept steady, or rose. It was now cheaper to import grain from the New World than to produce it at home. The production of milk had become more profitable than the feeding of cattle for export. Farmers quickly adapted themselves to the new circumstances, and by 1890 about 700 co-operative dairy factories, or half the number in existence now, had been established.

It was in these conditions that the agitation for small-holdings came to a head and succeeded in securing the appointment of a Commission of Inquiry, the report of which was embodied in legislation in 1899. State assistance by way of loan was offered for the acquisition of land and the erection of buildings, the interest on the loan being at a lower rate than the borrower could obtain in the open market.

There has been periodic revision of the legislation to bring it into accord with changed conditions, the most important amendment having been made soon after the end of the War, when a grant for buildings was provided to the extent of nearly one-third of the maximum cost allowed for buildings under the Act.

Up to 31st March 1933, over 15,000 owner-occupiers had been settled, with loans amounting to 140 million Kroner (at par 18·2 Kroner=£1); and further loans amounting to 19 million Kroner had been advanced in 10,800 cases for enlargement of land and additional buildings.

Besides these Acts for the settlement of owner-occupiers there is a series dating from 1919 in which the State is empowered to acquire land, to let it in small-holdings and to offer loans for the erection of buildings on the holdings. Under these Acts, 4,900 holders were settled up to 31st December 1933, with building loans totalling 56 million Kroner, and 1½ million Kroner for additional loans in 2,000 cases. The original Act of this series, that of 1919, provided that interest should be charged only on the amount of the maximum building loan that had been fixed, under the owner-occupier Acts, for the year 1914.

The loss incurred by the State, as at 31st March 1925, through the direct or indirect subsidies mentioned has been estimated at 41·3 million Kroner.

**The New Act.**—The new Act provides for the settlement of holders under the two systems already referred to, and prescribes much in detail, including the terms and conditions of assistance by loan, the size of holding, the qualifications of applicants, the procedure of application and the machinery of administration.

The Minister of Agriculture is required to approve the purchase of land and generally to issue rules and regulations for the carrying out of the Act. Subordinate to him is the Land Act Board, which has a separate office and is charged with the duties of selecting land for acquisition by the State, settling applicants and approving loans. The Board consists of fifteen members—three nominated by the Minister of Agriculture (of whom one is the Chairman, one represents the Ministry of Agriculture and the third the Ministry of Finance), ten by the Rigsdag, one by Farmers' Associations and one by Small-holders' Associations. The Board is assisted by three part-time Commissioners in each county, whose duties are chiefly to make local enquiry as to land and applicants and report thereon to the Board.

*Financial Provision.*—In each of the financial years 1935-36 and 1936-37 the sum of 5 million Kroner is to be provided for the acquisition of land by the State and for loans for the erection of buildings on such land; and also 6 million Kroner for loans to individuals for the acquisition of land and the erection of buildings. In addition to these sums, the sum of 400,000 Kroner per annum is made available for the purchase of land and houses at present rented or held on lease.

Loans may be made to Land Settlement Associations as well as to individuals for the purchase of land to be used for small-holdings and for the erection of buildings.

The rate of interest on loans is invariably 4 per cent per annum. Payment of the first instalment of principal is in some cases deferred for five years; and, for the smaller holdings only, where there is a loan for purchase of land, the first instalment of principal on the building loan is not called for until the land loan has been fully repaid.

The Act lays down the maximum loan available for the different classes of holdings, as follows :

| | Maximum Loan for Land | Maximum Loan for Buildings |
|---|---|---|
| Small Holding . . . | 8,500 Kr. | 8,000 Kr. |
| Market Garden . . . | 5,000 „ | 12,000 „ |
| Large Holding . . . | 30,000 „ | 15,000 „ |

*Size of Holding.*—It is prescribed in the Act that no holding to be formed or acquired shall be less than the equivalent of 7½ acres (except in the case of market gardens) or more than 37 acres in extent ; and that State assistance will not be provided for the enlargement of an existing holding beyond 20 acres. It is also prescribed that where the Land Act Board is subdividing a farm of 250 acres or over, one-third of the area should as a rule be used for holdings of the maximum size.

It is of interest to note in this connection that the average size of holding established has steadily increased since the first years of State assistance. For the first five-year period, 1900-1904, the average size was 8 acres ; in 1922-23 it was 19 acres, and in 1932-33 it was 22 acres.

*Limitations of Owners' Rights.*—Among the other provisions of the Act, the most important are perhaps those limiting the rights of the owner-occupier so long as a State loan is outstanding on the property.

The owner must live on the property and manage it himself. He may not sublet any part of it, nor build on it houses to let. In addition to insuring buildings, stock and implements against damage by fire with an Insurance Company approved by the State, he must insure his crops against damage by hail and his buildings against storm damage. The special consent of the Minister of Agriculture is required before any such property can be divided up or amalgamated or managed with other land. In the mortgage to the State there must be a provision to the effect that, if any of the above conditions are broken so that the character of the property is altered or its value reduced, the whole outstanding capital of the loan may be called in.

*Sundry Provisions.*—It will be sufficient to mention a few of the remaining provisions of the Act.

A successful applicant may begin by erecting smaller buildings than are generally considered necessary for the holding, and he is allowed five years in which to apply for the maximum loan available.

The Minister of Agriculture is empowered in special circumstances to allow as an experiment the erection of buildings on a holding before the holding has been disposed of in accordance with the Act, but at a cost not exceeding the maximum loan for the year. Such buildings and the property on which they are situated may be disposed of outwith the Act.

The rent of holdings let by the Land Act Board is to be determined in relation to the value of the land as assessed for land tax, and not in relation to the actual price paid.

Official returns show that the actual sale price of nearly 3,000 holdings of less than 25 acres was in 1932 about 24 per cent higher on the average than the land tax valuation for the same year.

The only preference indicated in the selection of applicants is for those who can prove that their savings have been made out of wages.

The Land Act Board is given power to acquire land for building-sites and plots in or near Copenhagen and provincial towns with a population of 1,500 persons and over.

**Agricultural Organisation in Denmark.**—This new Act comes into force at a time when in some quarters it is considered that the organisation of farming in Denmark is in the melting-pot. The question at issue is the form of organisation which will produce the best results for the country as a whole, and it arises chiefly from the situation obtaining since the fall of prices in 1930 and subsequent years.

The size of the most productive unit is usually measured from two different standpoints. For Denmark it has been calculated that, measured in terms of social output, the holding of 25 acres and under is the most productive ; and that, in terms of the output per person employed, the highest production is secured on the farm of 60 to 70 acres.

From the available returns of holdings and areas it would appear that, before the crisis of 1930 at any rate, there was a natural trend to the larger type of holding, and that the number of the smaller holdings increased mainly if not entirely as a result of State assistance. The following analysis will make that clear.

It may be noted in the first place that the agricultural land of Denmark is not chiefly farmed in the smallest unit. In 1919, the last year for which a return of the area covered by the various groups of holdings is available, there were 109,100 holdings of 25 acres and under with a total area of 1,203,000 acres, or only 14·7 per cent of the whole agricultural area, while the 25,500 holdings between 25 and 37 acres comprised 790,000 acres or 9·5 per cent of that area. At the other end of the scale, the large farm of 150 acres and over accounted for nearly 20 per cent of the total area. In the middle group, of 37 to 150 acres, there were 66,000 units covering over 56 per cent of the whole agricultural area.[1]

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[1] In these statements the hectare has been taken as equal to 2½ acres.

Roughly corresponding figures for Scotland in the year 1931 are as follows:—

| Size | No. of Holdings | Extent Acres | Percentage of Total Area |
|---|---|---|---|
| 1 to 30 acres . . | 44,050 | 420,000 | 9 |
| 30 to 150 acres . . | 22,600 | 1,750,000 | 38 |
| Over 150 acres . . | 9,200 | 2,460,000 | 53 |
| All holdings . . | 75,850 | 4,630,000 | 100 |

The "total area" is that of land under crops and grass, excluding rough grazings. There is a marked contrast between these figures and those for Denmark.

A return of the numbers alone of holdings in the year 1929 indicates that the smallest and the largest units had both lost favour in the intervening ten years, the number in each case having fallen by over 10 per cent.

The following table shows the distribution of holdings in further detail :

| Size<br>Acres | No of Holdings<br>1929 | <br>1919 | Extent<br>Acres<br>1919 |
|---|---|---|---|
| 1⅓ to 8 | 38,525 | 43,891 | 203,000 |
| 8 to 25 | 71,826 | 65,254 | 1,000,000 |
| 25 to 37 | 26,809 | 25,494 | 790,000 |
| 37 to 75 | 43,566 | 43,364 | 2,357,000 |
| 75 to 150 | 20,417 | 22,552 | 2,280,000 |
| 150 and over | 4,494 | 5,374 | 1,560,000 |
| | 205,637 | 205,929 | 8,190,000 |

In considering the increase the above table shows in the number of holdings in the groups 8 to 25 acres and 25 to 37 acres, it should be kept in view that in the ten years in question there were about 9,000 holdings formed with State assistance. The table further shows a considerable movement away from the smallest type of holding and an appreciable increase in the middle groups covering 25 to 75 acres.

Such a development appeared to support the contention that the best size of holding was to be found in the middle group and at any rate not over 75 acres. But since 1930 the level of agricultural prices and returns has put an entirely different complexion on the matter by bringing into the limelight the extent to which the mortgaging of agricultural property has endangered the farmer's ability to secure an adequate livelihood.

The latest returns on this point show that in 1926 agricultural property was mortgaged to over 60 per cent of its value. Compared with the year 1909 this was an addition of 9 per cent, while over the same period the ratio of mortgages to the value of all other forms of property was reduced. As the great bulk of the amount borrowed is charged with interest at 4½ per cent it will be readily understood that the persistence of low prices for produce creates a situation of no little difficulty. The Danish Government has assisted farmers since 1931, but even after the partial recovery made in 1933 special measures for the relief of mortgages had to be introduced last summer, providing for reduction of both capital repayment and rate of interest, and in certain cases a moratorium.

These are the circumstances which have led some people in Denmark to wonder whether large-scale farming may not ultimately have to be the solution of present difficulties. There are certainly grounds enough for disquiet so long as the majority of farmers, most of whom are in a comparatively small way, and many of whom acquired their farms in the days of high prices, are held between the Scylla of high interest rates and the Charybdis of low prices for their products. It is obvious that everything depends on whether and how soon the disparity between interest and prices can be made to disappear; but as to the answer to that double riddle, he would be perhaps doubly a fool who would venture one. It can at least be said, however, that for the time being the Danish farmer's mortgage burden is being lightened a little; and the new Small-holdings Act appears to offer, at least for the first few years, comparatively easy conditions for new holders.

(For official returns quoted above, the *Statistisk Aarbog for Danmark*, 1934, has been used. The estimate of the State's loss on small-holdings and the estimates of the productivity of holdings are from Hr. Jörgen Pedersen's book, *Husmandsbruget*, 1928.)

# SPECIAL SULPHUR DUST *versus* LIME SULPHUR FOR APPLE SCAB CONTROL

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**Introduction.**—The combating of the incidence of parasites, insect or fungoid, on cultivated crops is a matter of economic importance, particularly to the commercial grower. Good cultivation is a primary factor in the control of disease and insect pests, but this in itself is not enough, and the grower has in most cases to resort to spraying as a supplementary measure. Year by year this operation is becoming of increasing importance to the market gardener, nurseryman, amateur gardener, fruit-grower and farmer. The cost of spraying may be considerable; the time and labour involved may present difficulties; but every commercial grower now realises that unless he is in a position to market a full, clean and wholesome crop he has small chance of selling his produce at a profit.

**Apple Scab.**—This disease is the potential enemy of all who wish to grow a clean apple crop. Its brown, circular patches on the skin of the apple are familiar to most people. In its severe form it produces cracks in the fruit; this is, however, more pronounced in pears, which are liable to attack by the same disease. It is not easy to estimate the amount of fruit wasted through this disease, but to even the casual observer of neglected and unsprayed fruit trees all over the country it is evident that its prevalence is detrimental. Good results have been obtained in some areas by using Bordeaux Mixture, although its value as a fungicide for apple scab control has been offset by its russeting effects on the fruit and by injury to foliage (1). In other areas lime-sulphur wash is preferred, but in this case also injury to the foliage of some varieties is reported. Locality, climatic conditions, etc., may have some effect on the incidence of apple scab, and these influences may also determine the materials that can safely be used to control it.

**Trials of Lime-Sulphur and Special Sulphur Dust.**—In view of this, it was deemed advisable to begin a series of trials under Scottish conditions. These are being conducted at two centres :—

(1) The Edinburgh and East of Scotland College of Agriculture Gardens at Nether Liberton :

(2) Alburne Knowe, Markinch, Fife, through the courtesy of Miss Russell.

Previous to 1932 the apple trees in the College Gardens had not been sprayed according to any special programme for the control of apple scab.

The plantation contains the following varieties : James Grieve, Worcester Pearmain, Golden Spire, Grenadier, Stirling Castle, Warner's King, Ecklinville Seedling, Lane's Prince Albert, Bismarck and Bramley's Seedling. The trees are planted in sections, each section containing the same number of trees of each variety. The plantation has been pruned uniformly throughout the trials according to the variety. It is on rather sandy soil overlying sand and is not grassed down. The trees are about 24 years of age with an average height and branch spread of 10 feet and 9 feet respectively.

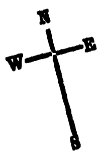
The orchard at Alburne Knowe consists of comparatively young standard apple trees. Except for a circular area, approximately 3 feet in diameter round each tree, which is kept cultivated, the whole plantation is under grass.

The varieties grown are Lane's Prince Albert, Bismarck, Bramley's Seedling, Grenadier and Early Victoria. During the autumn of 1932 the majority of the trees carried a crop of fruit showing severe damage by apple scab. The trial at this centre did not begin until 1933.

With a view to controlling the incidence of insect pests and cleansing the trees of lichen and moss, the trees have been washed with tar-oil preparations during each dormant season, at both centres, since the trials began.

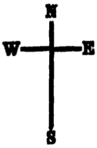
In order to test the relative value of special sulphur dust and lime-sulphur applications during summer as a control for apple scab the respective plantations were divided into three sections as follows :—

College Gardens



| Lime-Sulphur Spray | Special Sulphur Dust | Control |
|---|---|---|
| 57 trees | 54 trees | 21 trees |

### Alburne Knowe, Markinch



| Control | Lime-Sulphur Spray | Control | Special Sulphur Dust |
|---|---|---|---|
| 12 trees | 48 trees | 24 trees | 48 trees |

*Materials Used.*—The lime-sulphur used at each centre was a reliable proprietary make which may be obtained in most seedsmen's and nurserymen's shops. This was applied by means of an ordinary hand-operated spraying tank (such as is used for whitewashing farm buildings) at an average pressure of 120 lb. per square inch. The spray was applied in the form of a mist, the intention being to coat each leaf with the spray and to avoid spraying too much so as to make the spray run off the leaves. Casein was added on each occasion to the diluted lime-sulphur spray to act as a "sticking," "wetting" or "spreading" agent. Lethalate was used for this in one application. It is always advisable when using lime-sulphur as a spray to add a "spreader" since this increases the efficiency of the fungicide.

Throughout the trials at both centres the lime-sulphur has been diluted as follows :—

Pre-blossom applications: lime-sulphur, 1 part; water, 29 parts.

Post-blossom applications: lime-sulphur, 1 part; water, 99 parts.

Four ounces of casein spreader (powder) were mixed with water and added to each 15 gallons of dilute lime-sulphur. The amount of spreader used varies according to the hardness of the water.

The special sulphur dust (a proprietary article) was used at each centre. In the College Gardens it was applied with a hand-operated rotary dust-gun carried in front of the operator and strapped over the shoulders. This machine, which holds approximately 12 lb. of sulphur dust, produces a volume of dust which may be controlled by turning a small screw which regulates the output. The dust drifts through the trees in the form of a fog. At Alburne Knowe the sulphur dust was applied by means of one of the older forms of knapsack dusting-machine. This caused more fatigue and did not give so great a volume of dust as the more modern machine used in the College Gardens.

*Times of Application.*—Lime-sulphur has been used for two pre-blossom sprays throughout the trials at both centres :—

(1) At the green flower-bud stage, *i.e.* when the green flower buds are readily observed in the leaf rosettes formed on the fruit spurs.

(2) At the pink bud stage, *i.e.* when the pink petals show in the flower buds, but no flowers are open. This is one of the most important stages in the spraying programme, and should, on no account, be missed.

It has been shown that the period between the green bud stage and the period of full bloom is a critical time for the tree owing to the very large number of air-borne spores of the disease that are then in evidence (2). Moreover, careful timing of the pink bud spraying is most important, for if any flowers are open, injury may be caused to the foliage by a spray of the strength of one part in thirty. Two to three post-blossom applications, at the discretion of the grower, are advisable, but never less than two.

(1) At petal fall:
(2) 3 to 4 weeks after petal fall:
(3) about 6 weeks after petal fall.

Sulphur dust was applied at the same stages of growth as the lime-sulphur applications, but with a greater number of post-blossom applications and shorter periods between them.

In these trials all spraying and dusting operations have been carried out between the hours of 10 a.m. and 3 p.m., on some occasions during bright sunshine, but always when the foliage was dry. This was done to test the effect of the various materials on the trees under such conditions and also to eliminate the cost of overtime for the operations. It is generally thought that special dusts must be applied when the foliage is damp, *e.g.*, after a deposit of dew or a shower of rain. These trials have demonstrated that dampness of the foliage is not an essential factor in obtaining good results with sulphur dust as a control for apple scab. No detrimental effects have been observed that can be attributed to spraying or dusting during bright sunshine when the foliage is dry.

A calm day is not the best for dusting, nor is a very windy day; a slight breeze is beneficial, since it causes the dust to drift very slowly through the trees. After dusting operations one does not readily detect the particles of sulphur on the foliage with the naked eye; a hand lens reveals their presence over the entire leaf surface.

Sulphur dust appears to be harmless to the person applying it should he by chance get into the dust drift. It is, however, advisable to wear goggles or a piece of fine muslin over the eyes. If no eye protection is provided there may be no immediate discomfort, but during the washing of the face later one finds that the tear glands function very readily; fortunately this does not last for any great length of time.

A fairly calm day is the best for wet spraying with lime-sulphur, and apart from wearing an old raincoat no further protection is necessary.

**Results.**—The following tables give the results at each centre. No records were kept regarding the incidence of apple scab on fruits that had fallen before harvesting. Fruits showing the least trace of apple scab were counted as scabbed. The figures in each column give the percentage of clean fruits at harvesting.

YEAR 1932

COLLEGE GARDENS

| Variety | Lime-Sulphur | Sulphur Dust | Control |
|---|---|---|---|
| James Grieve . | 84·25 | 29·6 | nil |
| Worcester Pearmain . . | 99·65 | 65·66 | 27·2 |

ALBURNE KNOWE, MARKINCH

| Variety | Lime-Sulphur | Sulphur Dust | Control |
|---|---|---|---|
| | Not recorded | | |
| | Not recorded | | |

YEAR 1933

COLLEGE GARDENS

| Variety | Lime-Sulphur | Sulphur Dust | Control |
|---|---|---|---|
| Bismarck . | 80·5 | 82·14 | 30·66 |
| Lane's P. Albert | 99·33 | 98·6 | 31·25 |
| James Grieve . | 79·75 | 91·33 | * |

ALBURNE KNOWE, MARKINCH

| Variety | Lime-Sulphur | Sulphur Dust | Control |
|---|---|---|---|
| Bismarck . | 61·05 | 75·25 | 24·03 |
| Early Victoria . | 73·75 | 94·57 | 43·03 |
| Bramley's Seedling . . | 93·8 | 93·3 | 83·33 |

* Owing to pilfering it was not possible to check the results in this section.

YEAR 1934

COLLEGE GARDENS

| Variety | Lime Sulphur | Sulphur Dust | Control |
|---|---|---|---|
| Bismarck . | 92·85 | 90·57 | 60·3 |
| Lane's P. Albert | 100·0 | 100·0 | 90·0 |
| Golden Spire . | 99·53 | 99·15 | 95·7 |

ALBURNE KNOWE, MARKINCH

| Variety | Lime-Sulphur | Sulphur Dust | Control |
|---|---|---|---|
| Bismarck . | 100·0 | 92·23 | 92·84 |
| Lane's P. Albert | 100·0 | 100·0 | 88·92 |
| Early Victoria | 98·56 | 99·19 | 88·5 |

TIME, LABOUR, COST OF MATERIALS, ETC.

| | Material | Quantity for 57 Trees | Cost of Material | Labour | Time |
|---|---|---|---|---|---|
| College Gardens | Lime-Sulphur | 4 galls. concentrate | £0 18s 0d | 2 men | 11 hours |
| | Sulphur Dust | 56 lb. | 0 12s 6d | 1 man | 4 ,, |
| | | Quantity for 48 Trees | | | |
| Alburne Knowe, Markinch | Lime-Sulphur | 6 galls. concentrate | £1 6s 6d | 2 men | 13¾ ,, |
| | Sulphur Dust | 40 lb. | 0 9s 0d | 1 man | 7½ ,, |

Ample spray and dust were used throughout the trials to provide a thorough test ; rigid economy might have prejudiced the results, yet, on the other hand, less material may have sufficed to give efficient control of the disease. Under the heading of time for lime-sulphur spraying, allowance is made for carting water, mixing and applying the spray. The College Gardens figures relate to two pre-blossom and two post-blossom applications of each material. At Alburne Knowe the figures refer to two pre-blossom and three post-blossom applications of the respective materials. Different workers were employed at each centre.

The cost of the lime-sulphur is based on the cost of a 5-gallon drum at £1, 2s. 6d. retail price ; the cost of the sulphur dust at £1, 5s. per cwt. The use of an older type of dusting-machine may account for the longer time required for dusting and the amount of dust used at Alburne Knowe.

**Summary.**—It will be observed that both lime-sulphur wet spray and special sulphur dust appear to have some considerable effect in reducing the incidence of apple scab. The percentage of clean fruits in the control sections has increased each year. Probably the fact of reducing apple scab infections on treated trees may have assisted in eliminating additional sources of infection for the control sections.

Since the liberation of dormant spores of apple scab coincides with the period of growth between the green flower bud and the full bloom, the number of pre-blossom applications should be not less than two. These applications provide a protective covering for the young leaves and fruit, etc., against attack, and protection is better than cure. Though the leaves do not exhibit signs of injury due to lime-sulphur spray (1 + 29) in the pre-blossom stages, they appear to be very susceptible to such damage with a spray of this strength in the post-blossom stages. The variety Stirling Castle is very susceptible to injury from lime-sulphur. Care must therefore be taken to make the applications at the proper stages of growth.

Small cheap dusting-machines are now on the market which are suitable for the grower with a small number of trees.

One more observation remains to be made regarding the incidence of red spider. Throughout the trials, at both centres, neither lime-sulphur nor sulphur dust—despite the fact that no less than four applications of either have been given each year—was observed to have any appreciable effect in controlling this pest. This observation evidently does not coincide with the results obtained in some centres in England (3), (4).

These trials are being continued at both centres, for it is as yet too early to arrive at definite conclusions regarding the relative merits of lime-sulphur and special sulphur dust for controlling apple scab under Scottish conditions. Dusting certainly shows a considerable advantage in the saving of time, labour and cost of material.

**Acknowledgments.**—The writer wishes to thank Miss Russell for her kindness in placing her orchard at Alburne Knowe at the disposal of the College for these experiments, and the staff there and at the College Gardens for their valuable assistance in carrying out the tests; he is also indebted to Principal Shearer, Mr Chisholm and Mr Penman for advice in conducting the trials and in preparing the report.

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# THE CONDITION OF POTATO CONSIGNMENTS

T. P. M'INTOSH, Ph.D., B.Sc.

IT is frequently stated that the dressing of both seed and ware potatoes in Scotland is unsatisfactory and there appears to be a considerable amount of truth in this assertion. Those who have had an opportunity of examining consignments of seed potatoes intended for export maintain that more attention is paid to such consignments than to lots of seed and ware intended for use in Great Britain. It can also be stated with confidence that no other class of agricultural produce gives rise to so many trade disputes. There is undoubtedly room for considerable improvement, and the purpose of this article is to suggest how a better standard of dressing and handling can be attained.

The preparation of a consignment for the market does not begin merely at dressing time when tubers of undesirable size are eliminated, while diseased, mutilated and frosted tubers and dirt are discarded as far as possible. If the dressing is perfect, complaints cannot arise, even though the consignment has originated from a stock substantially affected with such a disease as blight or such a pest as stem-eelworm. It appears, however, that on the majority of farms it is practically impossible to eliminate at dressing time all the undesirable material. Various reasons may be given for this : the work may be too hurriedly done, the farmer may not give adequate personal supervision, or the weather at dressing time may be bad. In order therefore to reduce the amount of undesirable material that has to be removed at dressing time, steps should be taken from the very beginning to ensure comparative freedom from diseases, pests, mutilation, frost-injury, worm-holes, etc. Variety, soil, cultivation and pitting must be studied in turn. Errors made in connection with these may entail so much work at dressing time that poor samples will almost inevitably result.

**Disease in Relation to Soil and Variety.**—The incidence of many potato diseases may be determined by the soil in which the crop is grown. Skin spot, corky scab, brown scab, spraing, stem-eelworm and certain other diseases can, if healthy seed is used, be effectively controlled by avoiding land which consistently gives rise to affected tubers. Disease organisms can often be starved out of infected land, or at least reduced to a minimum, by the use of wide rotations. It may happen, however, that it is impossible to avoid the planting of potatoes on disease-infected soil and, in such circumstances, special precautions must be adopted. Should the land be known to produce spraing, very susceptible varieties, *e.g.*, Golden Wonder and British Queen, must be avoided. On such land it is best to grow crops, such as Majestic and King Edward, for seed and to cultivate so as to produce as little ware as possible.

Land which produces tubers regularly affected with skin spot constitutes a very difficult problem. Where it cannot be rested for long, very susceptible varieties, such as Kerr's Pink, must be avoided. It is undesirable to take seed off such land and the most suitable purpose to which it may be put is the production of ware for early consumption. As regards land which produces scabby tubers, improvements may be effected by attention to drainage and soil conditions; for advice on this matter the grower should consult the local representative of the Agricultural College. Drainage will reduce the incidence of blackleg. Cut seed should never be planted on ground that is naturally wet, otherwise blackleg may become prevalent.

Care should be taken to plant only sound seed; it is a bad policy to plant second-rate and, particularly, diseased seed in order to have more material to sell.

It cannot be too strongly emphasised that all measures of general hygiene, such as wide rotation, the burning of potato haulms after lifting, the adequate destruction of all tubers affected with disease, and the periodic disinfection of potato sheds, boxes and bags, will very materially assist growers in lessening work at dressing time and in improving the market quality of their consignments.

**Lifting.**—The greater part of the Scottish maincrop acreage is lifted by the potato digger, which from the point of view of speed and exposure of potatoes has advantages over the potato plough. The rigid spinner, however, causes a great deal of damage to potatoes and should never be used with tender varieties. The feathering spinner causes less damage and this can be still further reduced by the use of rubber on the prongs of the digger. Even with the aid of these appliances, so much damage is done in lifting that many farmers still persist in using the potato plough in spite of its obvious disadvantages. There is undoubtedly great need at the present time for an improved type of potato digger which will tend to minimise damage not merely when drawn by horses but when operated by tractor.

Lifting should, whenever possible, take place in dry weather. Where potatoes are lifted in a wet condition special precautions must be taken in the pitting. Mutilated and diseased tubers should not be pitted with healthy tubers. This point is fundamental. Further, diseased tubers should not be allowed to rot in the field. The general practice at present is for practically all visible tubers thrown out by the digger to be collected in baskets and carted to the pits. The suggestion that diseased and mutilated tubers should be separately basketed by the gatherers, and thus marked out for destruction, will probably be regarded by most farmers as impracticable, but where the acreage is not large it might be worth a trial. Harrowings should certainly be pitted separately.

If potatoes are dug whilst the foliage is still green and affected with blight, the tubers will become affected with this disease and many which appear healthy when going into the pit will come out rotten. If, for any reason, a crop must be lifted before the blighted haulms are completely dead, the haulms should be cut and removed or destroyed by spraying, *e.g.*, with sulphuric acid. At least ten days should elapse between cutting or destruction and lifting. When haulms have been infected with this disease, there should always be as great an interval as possible between the death of the haulm and the lifting of the crop. In this way and by the good earthing-up of crops during cultivation operations, the danger of introducing blighted tubers into the pits will be reduced to a minimum.

Should a field show plants affected with blackleg distributed more or less evenly, such plants should be duly dug out and the tubers removed as early as possible ; otherwise, the over-ground parts may disappear before lifting time although diseased tubers are still in the soil. Where the disease is limited to one part of a field—a wet portion, for instance—the potatoes on that part should be lifted and pitted separately and not used as seed.

**Pitting.**—While the construction of potato-pits is in general well understood, there are certain points that require emphasis. It is important that the site of the pit should be dry, well drained and exposed to drying winds. The orientation of the pits is frequently north and south, but no objection need be taken to pits running east and west provided adequate protection from frost is afforded on the north side. There is reason to believe that for potatoes required only late in the season the direction of the pits should be east and west. The temperature of the southern face of such a pit can be controlled by various methods. With sound potatoes, the size of the pit is not an important matter and a saving of both straw and labour can be effected by using wide pits. Potatoes lifted under wet conditions, however, should invariably be placed in narrow pits.

It is obvious that potatoes should, if possible, be lifted when ripe and dry. If, however, it is impossible to get them pitted in a dry state, such measures may be taken as using narrow pits, exposing the pit to drying winds and re-dressing before the final earth-up. The potatoes should be built up as steeply as possible for the twofold purpose of running off water and of relieving them as far as possible of the weight of the earth. Strawing should be carefully done ; if possible, six to eight inches of straight wheat or rye straw should be placed on the sides of the pit. The straw has several functions to perform, *e.g.*, to enable water to run off readily and maintain dryness, to insulate the pit from low temperatures outside and to keep the earth off the potatoes. Barley and oat straw although drawn straight is apt to pack and is not so suitable as wheat straw. Divots and rushes may also be used.

Potatoes, when pitted, always generate a certain amount of heat which must be allowed to escape. For this reason and also to give the tubers as long as possible to dry, the final earthing should be delayed as long as possible, having due regard to safety from frost.

Potato shaws should never be used for covering the pits, nor should the earth covering the pit be patted and smoothed off with the back of a spade, as this tends to let in the frost more easily.

Frequently, when seed is dressed out early in the season, the ware left behind is re-pitted carelessly, and this rough handling is apt to cause a great deal of bruising amongst the tubers. Such bruising, apart from rendering the tubers undesirable, frequently leads to the spread of disease; hence pitting must be carried out with the greatest care. Care should also be taken to avoid the opening of pits in warm weather in spring if the ware is intended for late use, as this is apt to cause sprouting.

**Dressing.**—What has been said above has reference to the presentation of the best possible sample for dressing. The dressing itself is the most important operation in connection with the preparation of potatoes for the market. Adequate supervision by the farmer is therefore very necessary. He must see that efficiency is not sacrificed for speed.

Improvements may be effected by increasing the efficiency of the machines and perhaps also by attention to the comfort of the workers. At present, most potato dressing at farms is done in the open, often in very inclement weather. It is conceivable that at some future time there will be central potato-dressing stations. This, however, is probably a long way off and even should such dressing stations be established in future, the grower will always have to dress at least a portion of his potatoes. Now, it is difficult for workers to dress potatoes when their hands are benumbed with cold and when the weather is such that the mind cannot concentrate on the work. Efficiency and discomfort are seldom associated. It may be worthy of consideration, therefore, whether it would be advantageous to have on farms movable shelters to protect workers during bad weather in which dressing must take place; in addition, the provision of some form of rests for workers to sit on, or rest against, when they are busy at the sorting conveyor might be considered. The use of satisfactory gloves would also undoubtedly help. It might be to the grower's advantage always to provide these. It is also necessary for the farmer to see that the number of workers employed in dressing is sufficient. This applies particularly to those working at the sorting conveyor.

As regards the mechanical part of dressing, the ordinary graips used in the lifting of the tubers on to riddles or hoppers do much damage and cause abrasions into which disease organisms may enter. Those graips which are specially blunted are much more satisfactory. Much damage is done to tubers when they are thrown on to the hoppers and the use of an elevator to convey the potatoes to the hopper might be distinctly advantageous. The "blinding" with some non-metallic substance of all those parts of dressing machines which cause injury is very necessary. It is sometimes difficult to eliminate diseased tubers at dressing time because they are covered with soil which conceals diseased tissue. The utility therefore might be considered of an attachment on the dressing machine by means of which tubers might be cleaned just before they arrive on the sorting conveyor. This certainly would not require much power and, if it were detachable, it could be exchanged for a clean one whenever necessary. Such an attachment, moreover, would not always be required; indeed, it would be used only on certain occasions when dirt was interfering with the efficiency of the dressing. Any invention which would enable the potatoes to be turned over on the sorting conveyor, so that the whole surface might be examined for disease, would also be helpful. Some Continental dressing machines are fitted with a device of this kind. Damage may be done to tubers while they are on the dressing riddles and there is no doubt that any improvement of the latter would be welcomed. In Germany, one firm has patented a specially prepared wire, coated with rubber, for use in riddles; this wire is stated to be very durable and to reduce damage. Mechanical contrivances must be considered from all standpoints and the failure to take into account the importance of small abrasions in connection with disease has hitherto been a weakness in the planning of machinery used for the potato crop.

**The Handling of Potatoes.**—Few growers realise how tender potatoes are and how easily they may be bruised; still fewer realise that these small bruises are the original causes of many complaints, being the points of entry of disease organisms. Apart from disease, however, it is not generally appreciated that a potato tuber may be bruised internally without there being visible signs on the skin and that such internal bruises may lead to darkening of the tuber flesh through chemical changes. This darkening of the flesh which is often erroneously attributed to disease, is frequent in potatoes sold in cities and is the cause of complaints.

That tubers are easily bruised may be readily demonstrated by letting a bag containing a number fall on a wooden or stone floor from a height of several feet. An examination of the tubers will reveal injuries, quite sufficient to permit the entry of disease organisms, on anything up to 70 per cent of the tubers. In the writer's opinion, the recent epidemics of dry rot can be explained, very largely at least, by injuries to tubers in the handling, more especially in shipments, combined with favourable seasons for the disease organism. From start to finish, the tubers should be handled with great care. In this connection the words of Dr G. H. Pethybridge, Plant Pathologist to the Ministry of Agriculture and Fisheries, may be quoted: " . . . there certainly does seem to be considerable room for improvement in the way seed potatoes are treated. If they could be regarded as being almost as delicate as fruit or eggs, it would not be amiss."[1] Seed potatoes should preferably be consigned always in new bags.

**Information Required.**—Improvements in the preparation of potato consignments are limited by the available information. Apart from the matters discussed above, more information is required on certain potato diseases and pests. New varieties that are particularly susceptible to such diseases as blight, spraing, skin spot and dry rot should not be allowed to come on the market, unless they possess very exceptional qualities in other directions. Skin spot and dry rot require further investigation. The present methods of dealing with the slug pest are unsatisfactory. Of recent years the variety Golden Wonder has been troubled with a darkening of the vascular tissue, which renders the ware unacceptable to householders. Affected tubers have been variously described, *e.g.*, as "sprainged," "frosted" and "affected with net-necrosis," and they may be found in many different types of soil, although there are fields and districts that are entirely free from the trouble. Considerable losses were occasioned last season on account of this darkening of the vascular tissue and the most progressive growers are convinced that the condition cannot be ascribed to frost or spraing. An investigation of this matter would be helpful. It appears also that a study of the machinery used in connection with potatoes abroad would be fruitful of result.

**Conclusion.**—The preparation of potato consignments for the market does not begin and end at dressing time. Great improvements can be brought about only after consideration of all the factors involved, from the selection of the ground and personal supervision to the handling of the dressed tubers. Particular emphasis must be laid on the adequate preparations of seed consignments. It is in connection with seed that most complaints arise and it is by means of seed that many diseases are distributed. Closer co-operation between growers and agricultural engineers is necessary for the improvement of the mechanical contrivances used for the potato crop. The problem must be viewed as a whole, and, above all, it must never be forgotten that tubers are living organisms which are readily damaged and destroyed. Further, it should be realised that many improvements in the preparation of consignments can be brought about with little additional effort or expense and that what is most desired is simply the appreciation of a few general principles the adoption of which would improve returns.

[1] Dr G. H. Pethybridge. "Potato Diseases." Report of Rothamsted Conferences, XVI, Problems of Potato Growing.

# THE RELATIVE ECONOMY OF TRACTOR AND HORSE POWER IN WESTERN CANADA[1]

ANDREW STEWART, M.A., B.S.A.

THE rapid adoption of mechanical methods of cereal production in overseas countries, which occurred in the years preceding 1930, aroused the very general feeling that a new situation had appeared, similar in many respects to that which developed with the opening up of the prairie lands of North America in the latter half of the nineteenth century. To adapt the words of Professor Fay, "The bogey of the years 1925 to 1930 was a bogey from across the seas. Its feet were ships of steel; its lungs were internal combustion engines; its arms railroads stretching across the prairies; and in its belly was Winnipeg wheat."

It is true that in recent years the "menace" of cheap cereals has, rightly, been attributed primarily to other factors, although it may still be contended that technical changes in methods of production contributed to some extent to the agricultural crisis. But, in view of the claims that were made with respect to the advantages of mechanical methods, it is interesting that so little is now heard of the practicability of employing these methods to minimise the effect of depression. From statements which received wide publicity, it appeared that producers in overseas countries were equipping themselves with tools of production which would enable them to reap adequate profits at prices for wheat no higher than 50 cents a bushel.[2] Such statements were by no means few in number, and the opinions they emphasised were very generally held.

In the years referred to, the effectiveness of mechanisation appeared to be supported by very substantial evidence. (In this article it is proposed to centre attention on the power unit and to omit any direct reference to those satellite machines which are so generally associated with the tractor in mechanical methods of production. Whether or not there is any *necessary* connection between the two, it is certainly true of Western Canadian conditions that, with few exceptions, the farms on which the large soil-cultivators, multiple ploughs, and harvesting-machines are found are those on which the tendency has been to make the tractor the principal, if not the only, source of power.) It became apparent that under the prevailing conditions there was, in fact, a marked tendency for agricultural output to increase in those areas where machine methods were being widely adopted. In Western Canada the period 1926 to 1929 was notable for a rapid increase in the production of field crops. The area under field crops in the prairie provinces which in 1925 comprised 33,216,453 acres had, by 1929, increased to 41,539,990 acres, thus showing an expansion of 25·3 per cent.[1] Similarly, Canadian wheat acreage, which had remained relatively constant from 1922 to 1925, rose from 20,790,000 acres to 25,255,000 acres or 21·5 per cent during the same four-year period. It was obvious that this expansion was being accompanied by the substitution of mechanical for horse power ; and this tendency indirectly contributed to the increase in marketable farm produce. Over the period referred to above, the number of horses in the prairie provinces declined from 2,379,730 in 1925 to 2,211,606 in 1929, *i.e.* by 168,124. It is true that these figures refer to all horses and as there was, no doubt, a drop in the number of horses used in the cities, the entire decrease cannot be attributed to changes in farm power. It is safe, however, to conclude that the expansion of 8,323,537 acres in field crops was effected without any increase in horse population. Assuming the same efficiency of horse power over the period, a simple calculation suggests that to operate the additional acreage by horse power alone, some 600,000 additional horses would have been required; and, if we allow 3 acres of land as the area necessary for the annual maintenance of a horse, this permitted the marketing of the produce from approximately 1,800,000 acres, which otherwise would have been consumed in the farms.

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[1] In this article "Western Canada" refers to the three prairie provinces of Manitoba, Saskatchewan and Alberta.

[2] See authorities quoted by Prof. J. A. S. Watson and A. Bridges. "The Future of Corn Growing," *Scot. Jour. Agric.*, vol. xiv. (Jan. 1931).

Again it was clear that the growth of mechanisation was resulting in a substantial increase in the efficiency of farm labour. In retrospect we can see that, between the years 1926 and 1931, the number of farmers in the prairie provinces increased by 12 per cent, from 248,162 to 288,079, while, as we have already noticed, the area of field crops increased 25 per cent, or twice as rapidly. In 1921 and 1931 (the decennial census years) the number of persons regularly employed in agriculture in the Dominion was 1,041,618 and 1,128,813 respectively.[2] At the same time the total acreage of improved land in farms increased from 70,769,548 acres to 85,803,645 acres, thus representing an increase of from 67·94 to 76·01 improved acres per person.[2] If the data were available for the prairie provinces alone, the increase in improved acres per person would certainly prove to have been greater than this. Concurrently with the increased efficiency of regular workers there was a substantial decline in the demand for casual labour. This is aptly indicated by the fact that the regular harvest excursions from Eastern Canada, which in the year 1925, for example, brought 45,000 harvest hands to the prairies, were discontinued after 1928.[2]

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[1] The general data, unless otherwise noted, have been obtained from Canada Yearbooks.

[2] Dr J. F. Booth. "Some Economic Effects of Mechanisation of Canadian Agriculture, with Particular Reference to the Spring Wheat Area." *Proceedings of the Fifth Annual Meeting of the Canadian Society of Agricultural Economists*, 1933.

## TABLE I

### TRACTOR AND COMBINE SALES IN WESTERN CANADA[1]

| Year | Tractors sold | Combines sold |
|---|---|---|
| 1919 | 8,844 | .. |
| 1920 | 12,279 | .. |
| 1921 | 3,428 | .. |
| 1922 | 4,222 | .. |
| 1923 | 4,166 | .. |
| 1924 | 2,112 | .. |
| 1925 | 4,053 | .. |
| 1926 | 6,513 | 176 |
| 1927 | 10,026 | 598 |
| 1928 | 17,143 | 3,657 |
| 1929 | 14,557 | 3,500 |
| 1930 | 9,108 | 1,614 |
| 1931 | 828 | 179 |

It is obvious, however, from the data in Table I that the adoption of tractor power has not proceeded in any even fashion. Since the war there have been periods when tractor sales reached impressively high figures; at other times there has been a marked decline in the demand for new machines. One period of rapid expansion of the use of mechanical power culminated in the year 1920 when sales exceeded 12,000. With the sudden fall in farm prices featuring the immediate post-war depression, tractor sales were severely restricted, and by 1924 the number had fallen to some 2,000. In the succeeding years sales increased, at first slowly then rapidly until the peak year of 1928 when 17,143 sales were recorded. Thereafter a steady decline occurred to the low level of 828 in 1931. Sales of combines, which only became appreciable in 1926, show similar variations from year to year.

These data suggest some interesting speculations. The fluctuations which they show bear a fairly close direct relation to the fluctuations in general economic conditions. During periods when producers were relatively prosperous, sales of tractors increased materially; in times of agricultural depression, sales declined. If mechanisation makes possible the considerable reductions in producing costs so frequently attributed to it, why has this tendency been evident?

Several explanations are possible. (1) In the first place it might be argued from the evidence that, even under the peculiarly favourable conditions in Western Canada, horse power is, in fact, more economical than tractor power. Assuming that this were the case, it would be necessary to find a reasonable explanation for the increased use of tractors prior to 1920, and again between 1926 and 1929. The only possible explanation would appear to be that, to the working farmer, the tractor represents a luxury which to some extent lightens his labour, and in which, in good times, he is prepared to indulge. Like that of the motor car, its use may be taken as a measure of material standards of living in the farming community. It could further be inferred, if this were the case, that the expansion of agricultural production between 1926 and 1929 could not in any way be said to be caused by the new technique offering prospects of increased rewards. While this explanation has been advanced it does not appear to be an entirely satisfying one.

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[1] *Canadian Farm Implements*, Dec. 1931.

(2) Again it might be said that as the data apply only to farmers' purchases of new machines, the explanation is that producers cannot, during a period of depression, find the capital required to purchase expensive machines, and that the figures do not indicate any decline in the use of tractors. It is true that at times when the farmer's income is, at best, small, and his credit is impaired, it is unlikely that he will be able to invest in costly machinery. Under the conditions that have prevailed since 1930 few farmers can have been able to show sufficient profits to justify heavy capital expenditure. In the pre-depression days it was, however, the "corporation"[1] farmer who claimed the greatest benefits from mechanisation, and this type should be able to obtain working capital more readily than the family farmer. That being the case we should expect to find an expansion of "corporation" farming during periods of low prices. No such tendency has been evident. It is rather clear that in times of depression the family farm has greater capacity for survival than its more imposing competitor.

Further, while it is true that the data for tractor sales do not necessarily afford an accurate measure of the actual utilisation of tractors on farms during any particular year, it is the case that, after 1929, there was an appreciable change-over from tractor power to horse power on Western Canadian farms. Not only were fewer tractors bought but it was apparent that many farmers, where possible, ceased using the tractors they already had, while others used their engines sparingly.[2]

(3) A third explanation covering this point would appear to be that, as the use of tractors involves the purchase of petrol and oil, the small cash returns which producers have received in recent years would seriously reduce the cash available for this purpose.

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[1] This term has been used to designate those large farms which were organised and financed as joint-stock companies.

[2] This statement is based on the writer's own experience and observations up to August 1933. No figures can be given to support it.

## TABLE II

### ANALYSIS OF TRACTOR AND HORSE COSTS

| Tractor costs | Per cent | Horse costs | Per cent |
|---|---|---|---|
| Fuel and Oil | 64·2 | Concentrates | 30·4 |
| Repairs | 2·6 | Roughage | 20·9 |
| Labour | 3·5 | Pasture | 3·8 |
| Interest and Depreciation | 29·7 | Housing | 10·4 |
| | | Labour | 32·4 |
| | 100·0 | Miscellaneous | 2·1 |
| | | | 100·0 |

(Data from farms in the Red River Valley, Manitoba, 1930.)

Table II shows the proportions of the different elements included in the total costs of horse power and tractor power of groups of representative farms in Manitoba, the data referring to the crop year 1930. Considering horse costs first, it is clear that, under Canadian conditions, only a relatively small part involves the expenditure of cash. Little purchased feed is used. Labour may include some cash payment but with the family unit preponderating the proportion of this is relatively small. On the other hand approximately two-thirds of the cost of tractor use (fuel, oil and repairs) represent cash costs. In the case of the farms under consideration this would involve an average expenditure of roughly £60—not perhaps a large sum but one which many farmers would be unable to find after they had met their pressing cash obligations. In many cases the sums expended for this purpose would be considerably higher than this, depending on the size of the farm and the extent to which the tractor was used.

(4) It is suggested that the preceding explanations do not necessarily provide a complete explanation, and that, in fact, other and more fundamental forces operate to cause fluctuations in power utilisation.

The unquestioned contribution of the tractor (and the machines associated with it) is that, by substituting capital for labour, it permits of the operation of the same area of land with the use of less labour: or, alternatively, it allows an increase in the size of farm without any, or without a corresponding increase in the labour employed. In Western Canada, where many farms contain a considerable proportion of unbroken land, and where the possibilities of acquiring land are greater than in this country, the adjustments necessary upon the change-over from horse to tractor power could, in many cases, be more readily made by increasing the improved acreage than by reducing the labour staff. That this procedure was largely adopted is evident from the following facts: (*a*) Between the years 1921 and 1931 the average number of workers per farm increased from 1·46 to 1·55[1]: (*b*) In the same period the average acreage of improved land per worker in Saskatchewan, for example, increased from 209·2 to 245·9 acres[1]: (*c*) Between 1926 and 1931 the average size of farm in Alberta increased from 370 to 400 acres[2]: (*d*) From 1926 to 1931 there was in each of the three provinces a considerable increase in the number and proportion of farmers both owning and renting land. The last two facts taken together suggest that many farmers were able to increase the size of their holdings by renting adjacent land.

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[1] Dr J. F. Booth, *op. cit.*

Now, if under normal conditions the costs per unit of production of cereals was the same, whether horse power or tractor power was used, it would follow, with one qualification, that the larger the acreage operated the greater would be the total returns to the individual farmer. The qualification is that yield per acre and quality of product do not differ in such a fashion as to cancel out the effect of larger acreage. Investigations have shown that, even under prairie conditions, there does appear to be a lower yield of crops per acre where mechanical methods are followed, and it is quite possible that, in some circumstances, the grade of the product may be inferior. There is, however, no evidence to show that these differences are sufficiently great to eliminate the effect of the larger area operated. The gross revenue does tend to be greater on the larger mechanised farms. Under the assumption of equal costs per unit, therefore, the net revenue would also be greater.

It is further evident that the greater the increase in gross productivity made possible by mechanisation, the greater may be the disparity between costs per unit (a disparity unfavourable to the tractor) without reducing net incomes to equality. It thus appears clear that, through its influence in extending the size of the productive unit, mechanical power may increase the profit of the individual farmer, even though costs per unit of production are greater than where horse power is used. Under these conditions, therefore, an expanding use of mechanical methods might be expected, provided that it was possible to adapt the size of holding to the new power unit.

Further consideration of the elements constituting tractor and horse costs (Table II) suggests that, under varying general economic conditions, total costs are unlikely to show the same variation. It is possible that, in fact, this offers a more complete explanation of fluctuations in power utilisation than the others noted above. The data in Table II refer to the year 1930, when it can hardly be said that normal conditions prevailed, but they can be used to draw certain useful conclusions. It will be noticed that fixed costs (interest and depreciation) and fuel and oil costs made up practically 94 per cent of the cost of tractor power. On the other hand the principal elements of horse costs were labour, concentrates and roughage; these three items accounting for approximately 84 per cent of the total horse costs. The relative rigidity of the prices of processed commodities and the violent fluctuations that occur in agricultural prices require no emphasis here. The prices of fuel and those of tractors are much more stable than the prices of oats and hay, or the wages of agricultural labour (in Canada). As a result, tractor costs vary much less from year to year than do horse costs. This means that when agricultural prices are low, horse costs will tend to maintain a relatively favourable position in comparison with tractor costs. Conversely in periods of relatively high farm prices the advantage will tend to be with tractor operation. It appears from this that changes in general economic conditions also exert a considerable influence on the relative economy of tractor and horse power.

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[1] Dr J. F. Booth, *op. cit.*

[2] *Census of Agriculture*, 1931.

The general proposition stated here requires qualifying to this extent, that the position of the owner and that of the prospective purchaser of a tractor will be somewhat different. The latter in deciding between alternative methods will take all elements of cost into consideration. Even if he is in a position to make a cash purchase, his choice will be influenced by considerations of capital outlay and depreciation as well as by the operating costs. On the other hand, the owner of a machine, like the owner of a manufacturing plant, may continue to use his machine as long as the operating costs are being met. It follows that if conditions become unfavourable to the use of tractors, the first effect will be to check purchases ; the use of available machines will respond more sluggishly and may become evident only if conditions move still further against the use of tractors.

### TABLE III

### MECHANISATION AND PRODUCTION COSTS

| Proportion of field work done by tractors Per cent | Total cost per acre (Dollars) | Total cost per 100 lb. (Dollars) |
|---|---|---|
| 75 to 100 | 7·13 | 0·96 |
| 25 to 75 | 8·32 | 1·02 |
| 0 to 25 | 7·38 | 0·91 |

(Data from farms in the Red River Valley, Manitoba, 1930.)[1]

Table III (the basic data for which again apply to 1930) suggests that, at the prevailing prices for the various constituents of power costs, the farmer using mainly tractor power would show no profit unless he obtained prices for grain equivalent to more than 96 cents per 100 lb. At that level of prices the horse farmer would be receiving a small profit.

The relative economy of tractor and horse power depends upon prevailing price relationships. In addition, as a result of the greater productivity and the larger producing unit associated with mechanical power use, profits will tend to increase more rapidly on tractor farms than on horse farms during periods of rising agricultural prices. Conversely with abnormally low prices the tractor farmer will tend to be the heavier loser.

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[1] The data in Tables II and III are taken from survey material collected by the the Canadian Pioneer Problems Committee.

The conclusions suggested in this article, at least with respect to Canadian conditions, are as follows : In the first place, the indisputable contribution of mechanical methods is to increase the productivity of the individual farmer. This increased productivity may offer the prospect of increased profits irrespective of whether costs per unit are lower or not, and to achieve this expanding productivity some increase in the size of the producing unit is necessary. It is possible that too much attention has been paid to the question of relative costs while the more fundamental factor has been insufficiently recognised, and that this has led to a misinterpretation of the developments that have taken place. Secondly, the relative economy of the two methods depends upon the prevailing price relationships. In periods of abnormally low prices the farmer using mechanical methods, both by reason of less flexible costs and because of his more extensive operations, will tend to be the heavier loser. On the whole, it would appear to be true of Canadian experience that before the crisis mechanical methods did offer the prospect of increased profits, but that at the prices prevailing during the past few years the advantage has probably, if anything, been with the horse farmer. On the assumption that these prices are abnormally low and cannot prevail permanently, it seems probable that when normal prices are again established the tractor will once more appear as the more economical source of power for farm operations.

## Aberdeen Pig Conference

A Conference on the Pig Industry was held on Monday, 18th March 1935, at Strathcona House, Rowett Institute, Bucksburn, under the Chairmanship of Mr J. Mackie, Coullie. Nearly 100 persons attended, among whom were representatives of the Department of Agriculture and of the three Scottish Colleges of Agriculture.

Mr A. H. Blissett read a paper on " Some recent developments in Pig Feeding and Management " in which it was suggested that producers should make greater use of their weighing-machines, not only for pigs but also for the food they consume.

In the production of a bacon pig the food cost amounts to approximately three-quarters of the total cost of production. It was suggested that by rigid control of the food intake not only would greater economy for production result, but also it might be possible to affect materially the quality of the carcase.

Mr Blissett illustrated his remarks by the results obtained in two experiments carried out at the Duthie Experimental Stock Farm. In the first experiment three groups of pigs were fed as follows: Group 1—*ad lib.* out of dry feeders; Group 2—as much wet food as the pigman thought the pigs capable of consuming; Group 3—rationed.

Pigs of 40 lb. live weight at the start of the experiment received 2 lb. of meal per day, and this quantity was increased by ¼ lb. per pig per week up to a maximum of 6 lb.

The average amount of food consumed per pig to reach 200 lb. live weight (all groups having an initial average weight of 40 lb.) was: Group 1—652 lb.; Group 2—585 lb.; and Group 3—561 lb., showing an advantage for rationed feeding of 24 and 91 lb. of meal per pig over Groups 2 and 1 respectively.

Against this saving of food, the fully wet-fed pigs (Group 2) took an average of three days longer, and the rationed pigs (Group 3) an average of ten days longer to reach bacon weight than the pigs in Group 1. This extra time taken to reach bacon weight was, however, negligible in cost because all the food eaten by the pigs during this period is included in the above figures.

On examination of the carcases it was found that the rationed pigs were thinner in the back fat and thicker in the belly than either of the other groups. The actual average measurements and grades were as follows:

| | Back in. | Belly in. | Payment grade |
|---|---|---|---|
| Group 1—(dry fed) | 1·98 (C) | 1·36 (C) | C |
| Group 2—(full fed, wet) | 1·87 (B) | 1·28 (C) | C |
| Group 3—(rationed, wet) | 1·64 (A) | 1·46 (B) | B |

In the second experiment only two groups were compared—Groups 2 and 3 in the former trial. The rationed pigs consumed an average of 23 lb. less food and took a slightly longer time to reach bacon weight, and once again graded out substantially better than the fully fed pigs, as the following figures show:

| | Back in. | Belly in. | Payment grade |
|---|---|---|---|
| Group 2—(full fed, wet) | $2\frac{1}{4}$ (D) | $1\frac{18}{32}$ (A) | D |
| Group 3—(rationed, wet) | $1\frac{27}{32}$ (B) | $1\frac{23}{32}$ (A) | B |

It was not suggested that the ¼ lb. weekly increase of food up to a maximum of 6 lb. is necessarily the best system on which to ration pigs, but from the results obtained in the two trials it would appear that haphazard methods of feeding are less satisfactory as regards both cost of production and carcase quality.

Mr Blissett also gave a brief outline of the Pig-recording and Litter-testing Scheme which had been in operation in the Aberdeen and Kincardine District since September 1934 After discussing briefly the objects and methods of the two systems of swine improvement, figures were given showing the progress which was being made in pig production in the ten recorded herds in the county:

| | |
|---|---|
| No. of litters | 121 |
| Total no. of pigs born alive | 1257 |
| Av. no. of pigs born per litter | 10·4 |
| Total no. of pigs weaned | 490 |
| Total no. of litters weaned | 72 |
| Av. no. of pigs weaned per litter | 6·8 |
| Av. weaning weight at 8 weeks | 32·4 lb. |

The Litter-testing Scheme was yielding interesting results, but as none of the litter groups had yet completed the test very few comparisons were possible. It was hoped that much useful information would be available after the scheme had been in progress for a complete year, despite the small amount of accommodation available which prevented more than six litters being recorded at the same time.

## Reviews

*Meat: A Summary of Figures of Production and Trade.* Imperial Economic Committee, IEC/C/1, H.M.S.O., price 1s. net.

A Report summarising the available information relating to production of and trade in meat in the principal countries of the world, with special reference to the part played by the British Empire, has just been issued by the Imperial Economic Committee and is of special significance at the present time.

Cattle numbers in the world as a whole appear to have declined during the past decade, while sheep and pig populations have increased. Beef production in the principal producing countries decreased between 1925 and 1931, but has since shown some recovery, according to the report. Production of mutton and lamb has expanded throughout this period. Pig-meat production has also increased, particularly in Europe, but by 1933 the output was beginning to decline and a further fall probably occurred in 1934.

It is evident that there has been a downward trend in beef consumption and a change-over to mutton and pork in recent years. Between 1925 and 1932, beef and veal consumption in the United States fell from 71 to 54 lb. per head, while pork rose from 68 to 72 lb., and mutton and lamb from 5 to 7 lb. In Great Britain, between 1925 and 1932, beef and veal consumption is estimated to have declined from 70½ to 62½ lb. per head, and pig meat and mutton to have risen respectively from 43 to 51 lb. and from 26 to 32 lb. In some countries at least, however, these tendencies were reversed in 1933. In Great Britain, for example, beef and veal consumption in 1933 increased to 64½ lb. per head, pig meat decreased to 45½ lb., and mutton and lamb remained about the same at 32½ lb.; there is little doubt that beef again increased in 1934, while pig meat declined further.

Between 1928 and 1933 aggregate exports of chilled and frozen beef and veal from the eight most important exporting countries declined by 23 per cent or over 3½ million cwt. The United Kingdom, despite a downward trend in imports, has taken an expanding share of world exports, accounting in 1933 for 84 per cent of the imports into the principal importing countries, compared with only 72 per cent of the same countries' imports in 1928. The Empire's share in the beef imports into the United Kingdom, which fell from 13 per cent to 10 per cent between 1926 and 1930, increased to nearly 25 per cent in 1934. Home-produced beef and veal in 1933 comprised nearly 46 per cent of total British supplies, a higher percentage than in either of the two preceding years, but one which was undoubtedly surpassed in 1934.

Exports of mutton and lamb from the most important countries increased by no less than 56 per cent between 1928 and 1933, but a slight decrease has since occurred. The United Kingdom has taken over 95 per cent of total imports into the chief importing countries in recent years. The proportion of lamb has increased from 59 per cent in 1928 to 75 per cent in 1934. The Empire's share of United Kingdom mutton and lamb imports in 1934 was 80 per cent, compared with 60 per cent in 1928. About 46 per cent of total British supplies of mutton and lamb in 1933 were home produced, or rather more than the average of other recent years.

International trade in pig meat is dominated by the movement of bacon and hams to the United Kingdom. This trade showed a material expansion between 1926 and 1932, but voluntary restrictions followed by a more permanent scheme of import control caused a considerable reduction in imports, which declined by 32 per cent or nearly 3·9 million cwts. between 1932 and 1934. The Empire's share of United Kingdom imports of bacon and hams had been declining for a number of years and comprised under 5 per cent in 1932, but rose to 17 per cent of the total in 1934. Home produced pig meat in 1933 accounted for 39 per cent of total supplies, compared with an average of about 35 per cent in the preceding five years. The Report suggests that the proportion increased substantially in 1934.

Beef prices in the United Kingdom withstood the depression rather longer and better than many other products. A fall occurred in 1931, however, and continued in the two following years; even in 1934 average prices were slightly lower than in 1933. Prices of mutton and lamb fell to a much greater extent than did beef between 1930 and 1932, but recovered appreciably in the two subsequent years. There was a very substantial decline in bacon prices between

1930 and 1932. The restriction of imports arranged at the end of the latter year, however, was followed by a marked price recovery, and by 1934 prices, particularly for imported bacon, were almost back to the 1930 level.

The Report also contains sections summarising the world trade in live cattle, sheep and pigs and in canned meat. In addition, accounts of the restrictions on imported meat in force in the United Kingdom and in the principal foreign countries are included.

*The Agricultural Register*, 1934-35. Agricultural Economics Research Institute. Oxford. 5s. net, 5s. 6d. post free.

This second annual volume provides an unbiased summary of everything that has been done in this country during the past year, whether by legislative means or by organisation within the industry, for the reconstruction or relief of agriculture. It is also a record of supplies and prices, agricultural statistics, labour conditions, the progress of land settlement, the supply of agricultural credit, and other matters such as tithe rent charge, licensing of bulls, foot and mouth disease, Colorado beetle, etc. In short, it is an indispensable reference book for anyone having an interest in agricultural affairs. Nowhere else can so much be found within the compass of a single book. To the harassed enquirer who has hunted in blue-books, newspapers, etc., in an attempt to assemble data concerning even one aspect of agriculture it will come as a great relief.

This present volume is much more comprehensive in scope than was its predecessor and the matter is exceedingly well arranged under the following headings—Legislation, Trade regulation, Administrative action, Supplies and prices, Statistics, Labour, Miscellaneous and Appendixes. One distinct improvement, to which the attention of Scottish readers is specially directed, is that matters relating to Scotland and Northern Ireland now receive equal attention with those relating to England and Wales. This was not so in the first volume. Attention also is not confined solely to what is often termed the new policy. For instance, seventeen Acts passed during the year are examined in so far as they affect agriculture. They include, among others, such diverse Acts as the Finance Act, the Unemployment Act, the Road Traffic Act and the Rural Water Supplies Act.

The Statistics relating to supplies and prices, to agricultural production and to the activities of the various commodity marketing boards permit the reader to measure changes which have taken place during the year, and also to gauge in some measure the degree of success attending various features of the "new policy."

The authors are to be congratulated on producing what is a most valuable reference book in so short a time.

*The Agricultural Marketing Acts.* H. M. Conacher, B.A. Edinburgh, 1935. W. Green & Sons, Ltd. Price 10s.

Sir Robert Greig, in his foreword to this book, refers to Mr Conacher's special qualifications for writing it. As Assistant Secretary in the Department of Agriculture for Scotland, he was associated with the administrative work involved in the preparation and passage through Parliament of the Marketing Bills and in the consideration of the various Marketing Schemes, especially those submitted by producers in Scotland; and he also had to deal with many questions arising out of the working of these schemes in practice. No one will deny that there was need for a clear explanation of the scope and purpose of the Acts and of the Schemes framed under them, and Mr Conacher's volume meets that need with the success that might have been expected from one whose knowledge and experience of the subject were so comprehensive.

The book opens with an introductory chapter describing the procedure laid down by the Acts, the powers conferred on Ministers of the Crown and on Marketing Boards and the functions of the various Commissions and Committees set up under the Acts. Mr Conacher extracts the essential points from the sometimes cumbrous and indirect language of legislation, and this chapter usefully prepares the way for the study of the Acts themselves.

There follows the text of the Agricultural Marketing Act, 1931, as amended by the two Acts of 1933, the amending provisions of the latter Acts being incorporated at suitable places in the text. Explanatory notes are inserted after each Section where required. Attention may be particularly directed to the notes on pages 67 to 71 and pages 76 to 78 dealing respectively with the finance of schemes and with their effect on existing contracts, which have given rise to a good deal of discussion and (in the first case) to litigation.

The text of the Agricultural Marketing Act, 1933, in so far as it has not been already dealt with, forms the next chapter. The more important sections are annotated, a specially full explanation being given of Sections (1) and (2). Finally the Agricultural Marketing (No. 2) Act, 1933, is briefly dealt with in the same way.

Of the four useful Appendixes, those of most general interest are the second, which gives a concise account of the Scottish and English Milk Marketing Schemes and the Hops, Pigs, Bacon and Potato Schemes, and the third, which specifies the offences created under the Acts and the penalties that may be imposed in respect of them. An exhaustive index forms a complete guide to the contents of the volume.

Mr Conacher's book should be of great value to the numerous classes of persons who are interested, from various points of view, in the problems of the organised marketing of agricultural produce.

*Education for Life.* A. A. Matthews, London. Thomas Nelson & Sons, Ltd. Price 2s. 6d.

The author of this exceedingly interesting publication is a country schoolmaster in the West Midlands of England. Faced with the problem of developing the minds and characters of country children along channels that would be particularly suitable for their life environment, he gradually modified his school syllabus in such a way as to enable it to have a profoundly rural bias. The story of how this was accomplished is set forth in the pages of this book and all who have rural education at heart would do well to read it. A beginning was made with a school garden. Then as time went on and experience was gained, other activities were in turn taken up. A poultry club was formed, then came pig, rabbit, lamb, calf and bee clubs. In five years time no less than £350 worth of stock had been raised and £90 of profit had been distributed amongst the club members who needless to say were the children themselves.

Educationally, gratifying and quite unlooked-for results were obtained. The teaching of motherless chicks to eat or drink or the feeding of baby rabbits by the aid of a fountain-pen filler was found to have a powerful humanising effect. The mysteries of life and death were freely discussed by the children in a frank, natural, yet reverential manner. This scheme of education was found to suit many a backward child, who was often discovered much to his own and his teacher's surprise to be capable of doing certain tasks better than anyone else. The story of these achievements is told in this book in a simple but interesting and fascinating fashion, and one feels impelled after reading it to try to develop the same ideas nearer home.

*The Soya Bean, its History, Cultivation (in England) and Uses.* Elizabeth Bowdidge. Oxford University Press. 1935. Price 6s.

The principal purpose of this book is to arouse interest in the cultivation of soya bean and to show that the bean can be grown profitably in England. The data by which the author supports her thesis are derived mainly from experiments carried out in Essex during the years of 1933 and 1934. It is, however, doubtful if results obtained in these very exceptional years can be applied generally. The bean has not been grown very successfully as a field crop in other European countries, some of which, to judge from their soya bean imports, have every inducement to encourage its cultivation. As regards England, the case would have been more convincing had the experiments covered a longer period of time. Independent experiments carried out by the Harper Adams Agricultural College in the West Midlands from 1924 to 1928 do not seem to have been so successful as the experiments of 1933 and 1934 in Essex. It is to be presumed from the author's statement on page 29 concerning the most suitable districts in England for the bean, that there is little prospect of the crop becoming a commercial one in Scotland.

The book contains many interesting facts about the bean and will doubtless interest readers. It is well illustrated but is somewhat expensive for its size, containing, as it does, only 83 pages.

*The Influence of Soy Bean Cake upon Milk Production and the Quality of Butter.* 1934. South Manchuria Railway Company.

The South Manchuria Railway Company has issued an interesting publication embracing the results of experiments and investigations on the influence of soy bean cake on milk production and the quality of the butter fat. No less than 1,500,000 tons of this cake are imported into Japan every year from Manchuria mainly for the purpose of manuring crops. The investigations referred to above point conclusively to the fact that this cake is a valuable feeding-stuff and that its use could be greatly increased.

Used for the purpose of milk production up to 50 per cent of the total starch value of the food, it gave most satisfactory results and did not appear to have any bad effect either on the quality of the milk or on the physiological condition of the cows. The butter produced, however, tended to be soft. To overcome this disability it is recommended that the amount used should not exceed 35 per cent of the starch value of the food used. It was also found that when this cake was compounded with such foods as copra meal the butter turned hard. It is desirable too that the fat-content of the cake should be still further reduced by improving the technique of oil extraction in the cake.

*The Evolution of the British Pig.* G. W. Layley and W. J. Malden. John Bale Sons & Danielsson Ltd., London. Price 7s.

For pig-breeders this is an interesting book. The title may suggest that it is of theoretical rather than practical interest. A perusal of the contents shows that it contains much that is of interest to present-day breeders. Only part of the book deals with the evolution of the different breeds of pigs in these islands and the various external influences. In this the authors are dealing with a controversial subject, and there are scientists who would disagree with some of their conclusions; but this does not make their story the less interesting. The illustrations of the ancient breeds are particularly attractive.

The true clue to the value of the book may be found in the introduction, where it is stated that the present type of pig is only one phase in the public fancy, and there is no particular reason why this should be more enduring than the many that have come and gone in the past 150 years. There is no solid ground, the authors state, "to suppose that the method of partially curing pork on the present lines will have permanency: the taste for a full cured bacon with its mellowness may return again." The authors are on sound lines when they decry the present tendency to concentrate on one breed and one type, to the exclusion of all other breeds. The consumer, they state, has always played the tune and the producer has danced to it. They believe that it is only a matter of time till our pigs will become better than the world's best.

In tracing the evolution of the modern pig, many points of practical interest are placed before the reader in an arresting style. In years past bacon was eaten as a food and not merely as a dainty fritter for dainty stomachs at breakfast-time mollified by an egg. At the present moment the pig-raiser has to provide for a public that wants tasteless cheese, butter, potatoes, and bread. In the old days margarine had not ousted animal fats and chocolates and sweets had not become carbo-hydrate substitutes for them, and lard was still in high favour in cooking. In these days the farmer has to provide for stomach decadents, and that has greatly altered the position. In the old days there was more virtue in fat and big joints than there is to-day.

The authors state that it is a myth that the Danes produce all their pigs to one standard. They point out that the Danes have no less than seven different grades for export and, counting two other sub-divisions, actually nine which they advertise publicly to the trade. This is a point frequently ignored by modern advisers concerning pig production in Great Britain.

The authors deal with the work of the Pig and Bacon Marketing Boards and decry the present method of grading bacon pigs in this country whereby the value of the belly is considered equal to that of the back. They point out that the Danes have a very low estimate of belly value. A strong plea is put forward for the nationalisation of all bacon factories. It is doubtful whether the majority of readers will agree with the authors in this respect. Probably a better solution of our present difficulties could be obtained if the State were to act as the umpire between the producer and the curer as to what was and what was not a grade A carcase. This would eliminate the present unsatisfactory method of adjusting an annual bargain both on price and on quality measurements.

There are sections dealing with modern breeding methods, fancy points, colour, porkers, and feeding methods. The thoughtful pig-breeder will find in this volume much to interest him.

*Farm Buildings.* Edwin Gunn, A.R.I.B.A. H. C. Long, "The Birkins," Orchard Road, Hook, Surbiton, Surrey. 1935. Price 5s. (by post, 5s. 4d.).

This very useful book on the design of farm buildings and the possibility of improving existing buildings is written by the late Superintending Architect, Ministry of Agriculture and Fisheries, and is published by Mr H. C. Long at the address given above.

The author describes his work as a guide for farmers, land agents and architects, and to these engaged in the consideration of building schemes for agricultural properties the book should prove of invaluable assistance.

Mr Gunn has set down in the briefest possible form the outcome of years of practical experience and touches on most of the technical difficulties that beset the design of farm buildings. He very aptly describes the difficulties of this work in his preface, where he states that "to a farmer many of the facts as to the use and desirable relationship of various buildings are so well known that he is unable to conceive that an architect may not be aware of them. . . . Conversely an architect or land agent will often fail to realise that a plan that is clear to him may be double Dutch to his employer."

He deals very thoroughly with the planning of buildings and the ruling dimensions of various parts and fittings in them, giving the reasons for these, and he further gives very considerable assistance by illustration and description of the necessary constructional details for buildings used for such diverse purposes as the housing of horses, the keeping of milk cows, the rearing of pigs, etc.

A warning should be given that, as is natural, the author writes purely from the English point of view, and the book takes no account of Scottish by-laws relating to building or of materials of construction peculiar to Scotland. Nevertheless, it contains a fund of useful information on which all concerned may have confidence in drawing as occasion requires. It should therefore commend itself to all progressive farmers, land agents and country architects. In view of the large number of photographs and plans included, the price is moderate.

## Farm Wages in Scotland

As before, the Department issued with their Monthly Agricultural Reports for 1st January and 1st July supplements giving tabular statements of the estimated cash wages and value of perquisites given to the various classes of farm workers at the Martinmas and Whitsunday terms. Those statements are summarised in this article, together with comparisons with the rates current at Whitsunday 1934.

In practically all districts wages are the subject of free contract between the parties concerned and in some cases difficulty is experienced in obtaining information regarding the engagements made. In several parts of the country, however, there has been a slight but decided increase in the cash wages paid to farm workers since Martinmas 1934, particularly in the case of experienced workers.

The pecuniary values of the allowances given, in addition to cash wages, as reckoned at each of the three terms mentioned above, are as follows :—

| | Whitsunday 1934 | Martinmas 1934 | Whitsunday 1935 |
|---|---|---|---|
| Meal, per cwt. . . . . | 16s. 9d | 16s. 9d. | 16s. |
| Milk, per gallon . . . | 1s. | 1s. | 1s. |
| Potatoes, per ton . . . | £4, 10s. | £4, 10s. | £3, 15s. |
| Coal, per ton . . . . | £1, 15s. | £1, 15s. | £1, 15s. |
| House, per annum . . . | £6 | £6 | £6 |
| Board and lodging for single men, per week . . . | 14s. | 14s. | 14s. |
| Bothy accommodation, with attendance, per annum . | £9 | £9 | £9 |
| Bothy accommodation, without attendance, per annum . | £6 | £6 | £6 |
| Keep of cows and followers, per cow, per annum . . | £10 | £10 | £10 |

The only items which show changes in estimated value as compared with last year are oatmeal and potatoes. The average wholesale price per cwt. for oatmeal for the ten years ended 31st December 1934 was 16s., while the average price for ordinary ware potatoes paid to growers for the same period was £3, 15s. per ton. In the case of oatmeal the long-term average price is below the value put on the perquisite at Whitsunday 1934 by 9d. per cwt., which would mean for men who receive 65 stone per annum, a difference in their wages of nearly 2d. per week. The value of potatoes has been lowered by 15s. per ton, making a difference of fully 3d. per week in the wages of men in receipt of one ton of potatoes per annum.

The arithmetical averages of the Department's figures for the wages of married men are as follows :—

*Average Weekly Earnings of Married Men*

| | Summer, 1934 | | | | | | Winter, 1934-35 | | | | | | Summer, 1935 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cash | | Allowances | | Total | | Cash | | Allowances | | Total | | Cash | | Allowances | | Total | |
| | S. | D. | S. | D. | S. | D. | S. | D. | S. | D. | S. | D. | S. | D. | S. | D. | S. | D. |
| Ploughmen | 25 | 10 | 8 | 3 | 34 | 1 | 25 | 10 | 8 | 3 | 34 | 1 | 26 | 0 | 8 | 0 | 34 | 0 |
| Cattlemen | 27 | 4 | 8 | 6 | 35 | 8 | 27 | 9 | 8 | 3 | 36 | 0 | 27 | 5 | 8 | 0 | 35 | 5 |
| Shepherds | 26 | 4 | 9 | 10 | 36 | 2 | 26 | 6 | 9 | 9 | 36 | 3 | 26 | 5 | 9 | 6 | 35 | 11 |

The total earnings in each case shows a small reduction as compared with those at Whitsunday 1934, but for each class the average cash wage was slightly higher than in the summer of last year.

*Married Ploughmen.*—The following table gives in round figures the weekly earnings of married ploughmen in summer 1935 as compared with summer 1934, in respect of 38 out of a total number of 49 counties and parts of counties included in the Department's wages statement :—

| County or District | | Summer, 1934 | | | Summer, 1935 | | |
|---|---|---|---|---|---|---|---|
| | | Cash | Allowances | Total | Cash | Allowances | Total |
| | | s. | s. | s. | s. | s. | s. |
| Wigtown | | 23 | 16 | 39 | 25 | 15½ | 40½ |
| Kirkcudbright | | 29 | 4½ | 33½ | 30 | 4 | 34 |
| Dumfries | | 32 | 3½ | 35½ | 32 | 3½ | 35½ |
| Selkirk | | 27½ | 6 | 33½ | 28 | 5 | 33 |
| Roxburgh | | 27½ | 6 | 33½ | 28 | 5 | 33 |
| Berwick | | 29 | 6 | 35 | 29 | 5 | 34 |
| Peebles | | 31 | 4 | 35 | 31 | 3½ | 34½ |
| East Lothian | | 29 | 3½ | 32½ | 29 | 3½ | 32½ |
| Midlothian | | 30½ | 3½ | 34 | 30½ | 3 | 33½ |
| West Lothian | | 31 | 3 | 34 | 31 | 3 | 34 |
| Stirling | | 36 | 6½ | 42½ | 36 | 6½ | 42½ |
| Dunbarton | Lower Clyde Valley | 36 | 3½ | 39½ | 36 | 3 | 39 |
| Lanark (N.W.) | | 35½ | 4 | 39½ | 35 | 4 | 39 |
| Renfrew | | 33 | 4 | 37 | 34 | 3½ | 37½ |
| Ayr (N.) | | 32½ | 6 | 38½ | 34 | 5½ | 39½ |
| Ayr (S.) | | 32 | 4 | 36 | 32 | 4 | 36 |
| Lanark (S.E.) | | 30 | 4 | 34 | 30 | 4 | 34 |
| Clackmannan | | 32 | 3½ | 35½ | 32 | 3½ | 35½ |
| Fife (S.W.) | | 32 | 3½ | 35½ | 32 | 3½ | 35½ |
| Fife (N.E.) | | 25 | 9 | 34 | 25 | 8½ | 33½ |
| Kinross | | 24 | 11 | 35 | 24 | 10½ | 34½ |
| Perth (S.E.) | | 24 | 10½ | 34½ | 23 | 10½ | 33½ |
| Perth (Central) | | 24½ | 10½ | 35 | 25 | 10 | 35 |
| Angus (S.W.) | | 24 | 10 | 34 | 24 | 10 | 34 |
| Angus (N.E.) | | 24 | 12 | 36 | 24 | 11½ | 35½ |
| Kincardine | | 20 | 11 | 31 | 20 | 11 | 31 |
| Aberdeen (E.) | | 19½ | 11 | 30½ | 19½ | 10½ | 30 |
| Aberdeen (N.E.) | | 19 | 11½ | 30½ | 19 | 11½ | 30½ |
| Aberdeen (Central) | | 17½ | 10½ | 28 | 18½ | 10½ | 29 |
| Aberdeen (S.W.) | | 19½ | 11 | 30½ | 19½ | 10½ | 30 |
| Aberdeen (N.W.) | | 18½ | 10 | 28½ | 19 | 10 | 29 |
| Banff (N.E.) | | 19½ | 10 | 29½ | 19½ | 9½ | 29 |
| Moray | | 20 | 11½ | 31½ | 20 | 11½ | 31½ |
| Nairn | | 18½ | 12 | 30½ | 18½ | 11½ | 30 |
| Inverness (E.) | | 18½ | 12 | 30½ | 18½ | 11½ | 30 |
| Ross and Cromarty (E.) | | 18 | 12½ | 30½ | 18½ | 12 | 30½ |
| Sutherland | | 17 | 14 | 31 | 17 | 13½ | 30½ |
| Caithness | | 14½ | 15½ | 30 | 15½ | 15 | 30½ |
| | | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| Average | | 25 8 | 8 2 | 33 10 | 25 10 | 7 10 | 33 8 |

The arithmetical average of the cash wages for these 38 areas is higher than last year by 2d., while the value placed on the allowances or perquisites is lower by 4d. In Wigtown the cash wage has advanced by 2s. per week, and in ten other districts advances up to about 1s. 6d. have taken place ; twenty-five areas show little or no change, but in two instances reductions are shown.

The range of the total wages, including cash and allowances, in the various divisions of the country, is as follows : in the southern counties from 33s. 10d. to 40s. 4d. ; in the Lower Clyde Valley from 37s. 8d. to 39s. 1d. ; in the remainder of the central area from 32s. 10d. to 43s. 2d. ; and in the north-eastern and northern counties from 26s. 4d. to 31s. 2d.

*Single Ploughmen.*—The average wage of single ploughmen in the south-eastern counties is 29s. 5d., or 1d. less than last year. In the south-western districts wages vary from 24s. 9d. in South Ayr to 28s. in Kirkcudbright. In the Lower Clyde Valley and North Ayr the cash wages average 15s. as compared with 15s. 5d. a year ago, with board and lodging valued at 14s. The average cash wage in the east-central division is 20s. 9d., an increase of 6d. on last year's figure, while the allowances, valued at 6s. 3d., show a reduction of 1d. In the northern and north-eastern counties the average cash wage is 15s. 9d. and the value of the perquisites 12s. 1d. In Scotland as a whole a single ploughman's wage is 28s. 3d.

*Women Workers.*—Where female dairy workers live on the farm the prevailing remuneration, including the estimated value of their board and lodging, ranges from 22s. 6d. in Orkney to 31s. 8d. for experienced workers in Dunbarton; the average figure being about 28s. 5d. In the Lothians and Peebles, where remuneration is wholly in cash, 23s. to 24s. per week is paid. Other women's rates, including board and lodging or their equivalent, vary between 21s. 8d. in Orkney and 29s. 5d. in North-west Lanark. Women paid by the day generally receive from 3s. to 4s.; in Wigtown, however, the wages paid range from 2s. to 3s.; in South-east Perth from 2s. 6d. to 3s. 6d; and in Stirling from 3s. to 5s. Women paid by the hour generally receive from 4d. to 6d.

*Boys.*—The wages paid to boys vary considerably according to ability and experience. Where they are engaged for a period of six months and receive cash wages in addition to board and lodging the total weekly remuneration ranges generally between 19s. and 25s. Where cash wages only are paid the rate generally varies between 13s. 6d. and 18s. ; some boys, however, receive only 10s. per week and others 12s.

*Girls.*—In the Lothians and Peebles girls generally receive 14s. per week, in Kirkcudbright from 12s. to 15s., and in Roxburgh and Selkirk from 10s. to 15s., with no allowances. Where board and lodging are provided the estimated total weekly remuneration is considerably higher, rates varying from 20s. 2d. to 27s. 6d. In North-east Angus and South-west Banff girls are paid 3s. per day.

*Casual Workers.*—Men are usually paid from 4s. to 6s. per day ;

in a few cases the rate is as low as 3s., while in others 7s. or 7s. 6d. is paid. Where engaged from week to week male workers generally receive from 25s. to 35s., while men paid by the hour receive from 8d. to 1s. Female casual workers are usually paid from 3s. to 4s. per day.

## Overseas Notes

### FURNISHED BY THE MARKET SUPPLY COMMITTEE

*Milk.*—Austria, Switzerland, Italy, France and the Netherlands are among the European countries faced with the problem of overproduction of milk.

In Austria surplus milk is to be made available for welfare institutions at a lower price than ordinary milk when it is utilised to supplement consumption. This cheap delivery will be made possible by permitting the agricultural co-operatives to make a slightly higher charge to the wholesalers for pasteurised milk. In addition butter will be delivered to welfare institutions at a lower price, the Milk Equalisation Fund being used to finance this measure. In Switzerland the supply of milk in schools is to be considerably extended, and propaganda for increased milk consumption is to be introduced.

In Austria, in addition to the measures indicated above, an Inter-Departmental Committee has been set up to investigate, *inter alia*, milk price margins and the possibility of reducing the price to the consumer without affecting the producer's price.

The prices which the German, Austrian and Swiss farmers are at present receiving for their milk show a marked similarity. At the current rate of exchange the producer's price for milk delivered in Berlin is equivalent to 13d. per gallon. In Austria the farmer receives from the creameries the equivalent of 13·3d. per gallon, and the guaranteed price in Switzerland is equivalent to 13·25d. per gallon. The retail price in Berlin for full milk at shop is 22d. per gallon; in Austria the average retail price is 20·7d. per gallon, and in Switzerland 22·6d. per gallon.

In Italy the consumption of fresh milk is being encouraged by the establishment of milk centrals in the large towns giving improved and regular supplies. Various measures have also been taken to stimulate the production and consumption of butter; these include an increase in the import duty on butter and the prohibition of the use of margarine except for the manufacture of biscuits, etc. The extension of pig-breeding—Italy, relative to its population, has the smallest pig holdings in Europe—is considered to be fundamental to the development of the Italian milk industry.

In France the prices of dairy products have been steadily falling since 1930. As milk and eggs were the only farm products bringing in an immediate return, farmers have been tempted to increase the supply. According to the General Federation of Dairy Farmers the output of milk in France has been increasing steadily since the War.

Foreign dairy products compete on the French market, while much land which was formerly under the plough has now been turned over to pasture; the number of milch cows has increased by a million (over 12 per cent) during the last eight years, and consequently the French production of milk has greatly increased.

In the Paris area producers' prices fell by 50 per cent between May 1930 and May 1935, but retail prices fell by only 26·6 per cent in the same period, although the present retail price is the lowest on record and lower than in most other countries. Typical prices in Paris are :—

| | Producers price Per litre (centimes) | Per gallon (pence) | Retail price Per litre (centimes) | Per gallon (pence) |
|---|---|---|---|---|
| May 1930 . . | 77 | .. | 150 | .. |
| May 1935 . . | 35 | 5·1 | 110 | 16·0 |

Regulations are already in force fixing a standard fat-content for cheeses, prohibiting the manufacture of all imitation dairy products with the exception of margarine and the sale of half-cream milk. These measures, however, are insufficient even as palliatives and the late Government introduced a Bill into the Chamber at the end of February providing for a complete reorganisation of the dairy industry. This Bill has now passed the Chamber, and in a modified form has gone to the Senate. The Government has set up a Commission of Milk Producers and Manufacturers of Milk Products to consider the reorganisation of the industry and has also appointed a Committee to study the development of exports. Much of the Government's hope for the future depends on the work of this Committee.

In view of the restriction of the home market and the loss of the principal export markets, it has been necessary to reduce the output of dairy products in the Netherlands and this has been carried out by drastic measures for reducing the number of live stock. At the same time it has been necessary to subsidise milk production as a measure of relief to the farmers. The measures already taken, which include compulsory slaughter on a large scale and the supply of cheap tinned meat for the poorer classes of the population, have not been enough. The older and less valuable animals have been killed off, but their places have been taken by the younger cows coming into milk and the amount of milk produced has been getting larger rather than smaller. It has become necessary to reduce the output of milk at all costs and, with this end in view, the scope of the milk subsidy is to be reduced so that only certain categories of milk qualify for subsidy.

The reduction is to be based on each producer's output in the last two calendar years. Any milk which is not sold, or is not manufactured by the producer, is left out of account. Whenever possible the reduction will be based on the total of milk fat produced. The average reduction for the whole country is 11 per cent, but scope is given for this percentage to be varied according to circumstances. The period during which the reduction will be applied covers the whole year, in order that the farmer may make arrangements suitable to the circumstances of his own undertaking and that the seasons of both heavy and light production may be included. The amount of reduction varies from one district to another and need not be uniform for all farms in the same district. The manufacture of butter and cheese on the farm is to be prohibited in practically all cases so that the temptation to produce more milk than will qualify for the subsidy will be reduced as far as possible.

One area in the west of the country will be exempted from the new regulations. This is a long-established region of dairy farms which will be specially treated as the main source of liquid milk for the whole country.

From the 1st June the price of manufacturing milk will be fixed at 2·96 cents per kilogram (about 4½d. a gallon), the fat-content being 3·2 per cent. This corresponds to a price of 77·7 cents per kilogram (11½d. per lb.) of butter and 92·5 cents per kilogram (about 1s. 1¾d. per lb.) of milk fat. The rate of subsidy on the smaller amount of milk which qualifies for it will be raised and this will lead to an excess of expenditure over income on the part of the Agricultural Crisis Fund. The difference is to be covered by a special reserve derived from a levy on exports to countries which apply quantitative regulation to Netherlands products.

*Pigs.*—The over-production of pigs in Switzerland appears to be as serious as the over-production of milk and the two problems are closely related to one another. The pig population is now 1,200,000 as compared with 500,000 to 600,000 in 1914. Plans advocated to reduce pig holdings include (i) the gradual reduction, through Government measures, of the number of milch cows, leading to a reduction in skim or butter milk for pig feeding, and (ii) the restriction of imports of feeding stuffs.

Austria is also faced with the problem of over-production of pigs which is causing a general depression of cattle prices. Vienna is reported to have consumed in 1934 about 142,000 more pigs than in 1933. Large unrestricted import of feeding stuffs has encouraged a considerable increase in pig holdings. Quota regulation of pig production is declared to be impracticable owing to the very large number of small-holders, and a check on imports of feeding stuffs is suggested as the most practical solution.

*Eggs and Poultry.*—In Germany the rigid system of control of egg marketing introduced in February 1934 has since been modified on two occasions. Poultry farmers under the original scheme were compelled to make use of common grading and marking stations, poultry food was obtainable only in return for the delivery of a corresponding number of eggs, and the industry was covered by a network of collecting stations which centralised supply and distribution. In June 1934 a less stringent system was introduced which was in effect a mixture of free trade and centralised control, and met with numerous difficulties in practice, which the new decree of 7th February 1935 is attempting to meet by increasing the flexibility of the control. The principal provisions of the new scheme are as follows :

(1) Dispatches of eggs from one economic district to another up to 5,000 per day are not subject to restriction.
(2) Dispatches of 5,000 to 20,000 per day must be notified in writing by the sender to the appropriate Association of his district.
(3) Dispatches of more than 20,000 eggs per day must be approved by the main Association.
(4) Eggs distributed otherwise than through the wholesale trade need no longer be marked.
(5) Producers may now sell direct to large customers without the intervention of the wholesale trade or of the Co-operatives.

*Market Garden Produce.*—In Germany the producing, processing and distributing branches of the market garden produce industry have been organised by a decree of March 15th in a manner similar to that adopted for grain, cattle and milk. The aim of the decree is the organisation of marketing through the regulation of production, sale and utilisation, as well as of prices and price margins. The fixation of prices and price margins requires the approval of the Minister of Food and Agriculture. In the Netherlands an export monopoly of fruit and vegetables to Germany, with the object of avoiding a further accumulation of outstanding settlements between the two countries, has been set up as from 1st April. The administration of the monopoly is in the hands of the Netherlands Fruit and Vegetables Central.

*Price Control in Germany.*—The principal Association of German Potato Merchants have made an effort to stabilise the price of potatoes throughout the whole of the last season. Last autumn a maximum price was fixed at a relatively high level with the object of preventing too large a proportion of supplies being used as fodder. In the winter, when it was necessary to protect consumers by fixing a minimum price, the existing price was maintained for this purpose. The minimum price remained throughout the winter and the usual seasonal rise of prices did not take place. To prevent any rise of price during the last few weeks of the season the minimum price has now been declared a maximum. One effect of the stable price has been to reduce surplus storage from 60 per cent to between 10 and 15 per cent above the pre-war level.

In Bavaria the Food Controller has fixed the maximum retail price for first-quality stall-fed beef at 80 pfennigs per ½ kilogram (about 1s. 2½d. per lb.). This price must not be exceeded except for "roast beef," fillet and sirloin. Any retail prices lower than the maximum at the time when the Order comes into force must not be raised, but exemption can be made in certain cases. This is probably the first time since the War that the retail price of particular cuts has been fixed by authority in Germany.

Another example of official intervention in regard to stabilised prices is shown by the new German regulations regarding the weight and marking of bread. Price fluctuations in the grain market had led bakers to ask for official measures to stabilise the price of bread and to have the authorised weight of loaves changed to correspond with the agreed price. This practice, which concealed rises in the price of bread from the consumer, was ended in June 1931 by the law prescribing a fixed weight for the loaf of rye bread. This system of a fixed weight loaf will now be extended to cover all other kinds of bread. The weight is to be clearly marked on the loaf. In future, rye bread must weigh at least 750 grammes against 500 grammes as hitherto, or the total weight must be divisible by 250. Wheaten bread, which has hitherto not been regulated, must now weigh at least 500 grammes per loaf. Fancy bread sold in slices may only be supplied in quantities of 125, 250 or 500 grammes. This regulation is welcomed as putting an end to unfair competition. While the actual price paid by consumers may vary from time to time, it will no longer be possible for a variation in the weight of the loaf to nullify the effect of what was supposed to be a stabilised retail price.

## Publications of the International Institute of Agriculture

*International Year-book of Agricultural Statistics*, 1933-34.—This Year-book, which has been published recently by the International Institute of Agriculture, Rome, provides an extensive, complete and exact summary of statistical information for agriculture of a quite unique kind. Every agricultural product reaching international markets is included, *e.g.*, wheat, wool, cotton, tobacco, sugar, tea, oilseeds and many others. For the reference library, the economist, financier, merchant, manufacturer and farmer, these concise and exhaustive tables are of the highest value. Agricultural engineers, implement makers and persons engaged in the fertiliser trade will also be particularly interested. The Year-book may be obtained from the Institute, price 90 liras (£1, 10s. at current rate of exchange), plus 10 per cent for postage.

*Annuaire International de Legislation Agricole, vol. xxiii.*, 1933.—This annual publication contains the most important legislative measures of the year, with, in addition, an analytical introduction. For the less important laws the title only is given, in the original language and in French. The Year-book has two indexes, one a chronological index by countries, the other an alphabetical index by subjects. This Year-book is of great interest to all who, as legislators or economists, are interested in agriculture, as well as to agricultural associations and persons engaged in the trade in agricultural products or in the allied industrial processes. The volume may be obtained from the Institute, price 75 liras (£1, 5s.), plus 10 per cent for postage.

*State Aid to Agriculture.*—The Institute has also issued the first number of a quarterly publication under this title, which is described as "an international summary of government measures affecting the prices of cereals, meats and dairy produce." The present issue covers the United Kingdom, France, Germany, Italy and the Netherlands. In subsequent issues similar reports will be added for other countries that are important producers or consumers of the products dealt with. This enterprise has been undertaken in consequence of a resolution passed by the General Assembly of 1934, and it provides for the first time a guide to the numerous measures affecting the important agricultural commodities mentioned above. It may be obtained from the Institute, price 25 liras (8s. 4d.) per annum, post free.

Another useful publication of the Institute is *The Agricultural Situation in* 1933-34, which is an economic commentary on the Year-book of Statistics; price 25 liras (8s. 4d.), plus 10 per cent for postage.

## Agricultural Conditions

THE weather during March was varied. In several north-eastern counties heavy rains were frequent during the early part of the month, frosts occurred and snow fell in places, while in the north and parts of the west rain, sleet and high winds were experienced during the latter half. Conditions in other parts of the country were generally very favourable for cultivation. Unfavourable weather prevailed in most districts during the first two or three weeks of April and, owing to the sodden state of the ground, farm work was held up considerably. Snow fell in several northern districts and the rainfall was generally very heavy, particularly in Perthshire and the north-east; in Banffshire many fields were flooded. In South-East Perth all seeding and planting operations were delayed by about a fortnight. During May the weather was exceptionally dry throughout the country, particularly during the first fortnight, and crops were affected by lack of moisture. Frost of unusual severity for the season, accompanied in some cases by snow, occurred in the third week. Growth was thus in most districts further retarded and vegetation suffered a very severe check, while serious damage was done to fruit crops. Live stock generally suffered from the unfavourable weather and farm work in many districts was retarded.

At the beginning of April autumn-sown wheat was making steady growth and plants were strong, healthy and vigorous in most districts. During that month the crop continued to make good progress in most districts, in spite of rather unfavourable weather conditions. In Angus, however, normal growth was somewhat retarded, particularly on wet, heavy land. In several areas the crop suffered temporarily from the wintry conditions in the middle of May, growth being retarded and the plants losing colour badly. In North-East Fife some rust was reported, but this affection was later overcome by rain. In this district also a considerable acreage was looking brown at the end of May, and in places had thinned out somewhat. Plants also lost colour in most parts of Perthshire. In Stirling most fields were expected to recover from the effects of drought and frost, but straw would probably be short. From a preliminary estimate for the whole country it appears likely that the area under wheat will show an increase of about 7,000 acres.

The preparation of the land for spring sowing was carried out with little interruption, and in most districts an excellent seed-bed was secured. By the end of March the seeding of barley had been completed in the Lothians, but elsewhere sowing was by no means general during the month. By the end of April, however, despite broken weather in the earlier part of the month, the work was completed in most areas. Germination generally was satisfactory but was retarded in Moray and South-East Perth. During May barley suffered less than wheat from the severe frost in mid-month. Late-sown barley, however, though brairding regularly, was afterwards severely checked by frosts and dry weather. In North-East Fife there were some complaints of wire-worm. Estimates of the area under barley this year indicate that there will be a decrease of about 7,000 acres in the total area under the crop.

The sowing of oats made good progress during March, and it was finished in most districts by the end of April. Germination generally was quite regular, but in Upper Moray and South-West Banff some very early fields had to be resown. By the end of May early-sown oats were generally looking well, but the growth of later sowings was checked considerably by frost and drought. On the better classes of land the crop stood the adverse conditions fairly well, but on poorer or higher land plants were in many areas thin, sickly and more backward. In Stirling many fields in exposed districts were showing a 50 per cent loss of braird. So far as could be ascertained from estimates at the end of May the total area under oats this season will show an increase of about 13,000 acres. Substantial increases are reported from Central Aberdeen and Ross and increases of about 5 per cent from five other districts.

At the beginning of June beans were generally a strong and healthy crop, having made good progress since brairding. No disease was reported, but growth was somewhat backward in parts of Perth and Stirling.

The work of planting early potatoes was generally completed in south-western counties by the middle of March, while in Fife and the south-eastern counties the work had been overtaken by the end of the month. By the beginning of April the preparation of the land for maincrop potatoes was well advanced. Planting, however, was delayed in many areas during the earlier weeks of April by the wet condition of the soil, and in the east and north-east planting was much retarded. Conditions for planting were good in western districts, and in Lanark the work was almost finished by the end of the month. Inverness, Moray and Nairn were also favoured with suitable conditions for planting. Planting was completed in all districts during May. Early varieties in the south-west were well advanced and the crop promised to be earlier than usual ; the dry weather, however, during the first half of May, followed later by severe frost, seriously affected the prospects of the early crop, particularly in eastern areas. In South-West Perth it was estimated that 20 per cent of the early crop has been frosted down, while in Berwick and Roxburgh early varieties growing in gardens and small lots were all blackened. As a result of the set-back to the growth of the plants the lifting of the early crop would be delayed in most areas by from two to four weeks. Estimates of the area planted indicate that the total acreage will be about the same as last year.

By the end of May the sowing of turnips and swedes had been almost completed in most districts. In North-East Fife, owing to the difficulty experienced with " yellows " last season, the sowings this year were mainly of swedes. Owing to the frost, re-sowing had to be undertaken in Ayr and Kirkcudbright. Rain was generally required to assist the growth of early-sown young plants, but no trouble from insect pests was reported. Owing to the frost the brairding of sugar beet was reported to be backward in most districts. In a few cases crops had to be ploughed down, while in North-East Angus, in those areas where the frost was most severe, the crop had to be re-sown. It is estimated that the total area under this crop will be similar to that of last year.

Aided by copious rains in many districts in early April, followed by genial heat, ryegrass and clover seeds made great progress and were generally in a vigorous and healthy state by the end of the month. Clover was said to be plentiful. The crop suffered from the cold and dry weather during May, rain and heat being badly needed in many districts. By the beginning of June the crop generally was not well grown, hay being short in the stalk, and a heavy crop was not expected.

Severe frosts and winds during the month of May caused serious damage to fruit blossom in almost every district. In South-West Angus currants suffered most, while in Central Perth apples and pears in exposed positions were quite destroyed. In North-East Fife all tree, bush and ground fruit were greatly damaged and crop prospects were poor. In North-West Lanark plums, gooseberries and red and black currants were regarded as a complete failure. The raspberry crop promised to be only 25 per cent of the average, apples and pears half the normal, but strawberries about the same as usual.

At the beginning of April ewes were generally in excellent condition and prospects for lambing were very good. The crop of lambs so far had been satisfactory. In Berwick the fall was reported to be the largest for many years, while in South-West Angus the percentage of twins was high. In some areas the progress of hill sheep was retarded by drought. In the Cowal and North Argyll areas trembling in lambs occurred, while in Roxburgh there were numerous cases of louping-ill among older sheep. By the end of April the fall of lambs was reported to be above average, and final reports showed that the season generally had been very satisfactory.

At the beginning of May the supply of farm workers was generally sufficient throughout the country. In Renfrew and North Ayr, however, good dairy workers were not too plentiful. At the Whitsunday hirings a number of both married and single men (but fewer than last year) were unable to find employment.

## SCIENCE AND PRACTICE

*The following extracts and summaries are supplied by members of the staffs of Scottish agricultural colleges and scientific institutions or are taken from recent bulletins of the International Institute of Agriculture. Full references to the original publications may be obtained on application to the Secretary, Department of Agriculture, York Buildings, Edinburgh.*

### CROPS AND SEEDS

**The Percentage and Viability of Weed Seeds recovered in the Faeces of Farm Animals and their Longevity when buried in Manure.** *George W. Harmon and F. D. Keim. Jour. Amer. Soc. of Agronomy, Vol. 26, No. 9,* 1934.—The objects of the investigation were to determine (*a*) the percentage of certain weed seeds that would pass apparently uninjured through the digestive tract of farm animals, (*b*) the percentage of recovered seeds which were viable, and (*c*) the longevity of the seeds in fermenting manure.

Amongst the seeds collected the following may be mentioned here: Field bindweed, smooth leaf dock, wild rose, and perennial pepper grass.

Definite numbers of seeds were fed to animals and the faeces were collected every eight hours for four days. The seeds were recovered daily by a process of washing and decantation.

An average of 14·2 per cent uninjured seeds was recovered from calves, horse, sheep, hogs, and chickens fed with various weed seeds. An average of 6·7 per cent viable seeds was recovered from each 1,000 seeds fed to all the animals. After being buried one month in cow manure and horse manure, velvet weed, bindweed and pepper grass seeds were viable. Bindweed seeds germinated one per cent after three months in manure, while all other seeds were dead.

**Blue Colour in Malting Barley (Blåfärgning av maltkorn).** *O. Tedin. Sveriges Utsädesförenings Tidskrift, Årg. XLIV., H.* 6, 1934. — Extracts from the writer's English summary. Blue colour in the aleurone layer has been observed in several lots of Swedish malting barley of the 1934 crop, a phenomenon not observed before in two-rowed Swedish varieties, but well known from six-rowed barley from northern Sweden.

Investigations have shown great differences between varieties in the tendency to develop the blue colour.

As to the cause of the colouring it is concluded that it is only developed under extreme weather conditions in such varieties that have the necessary genetic constitution. The year 1934 was extremely dry and warm, but 1933 was also unusually warm and dry.

The development of the colour seems to be favoured by the same factors which cause premature ripening of the seed. In some varieties, which are sensitive in both respects, a high percentage of blue seeds is therefore an indication of premature ripening. In other varieties, however, many seeds may be coloured, in spite of normal ripening; in other varieties again, even premature seed-lots may lack blue-coloured kernels.

**Toxicity of Air containing Sulphur Dioxide Gas.** *P. W. Zimmerman and William Crocker. Contributions from Boyce Thompson Institute, Vol. 6, No. 4.*—Occasionally plants growing near industrial towns are damaged by smoke emitted from factories. It was found that practically all the injury to vegetation from smoke fumes was due to sulphur dioxide gas which was liberated in large amounts and was carried for long distances in sufficient concentration in the atmosphere to cause injury to plants. A description is given in this paper of results obtained when plants were exposed to known concentrations of sulphur dioxide gas under a number of different conditions.

The plants used in the experiment were grown in pots either in greenhouses or in frames, depending on the nature of the experiment. The following plants were included: alfalfa, barley, buckwheat, castor bean, meadow fescue grass, oats, rose, rye, sweet pea, timothy, tomato, turnip and wheat. Plants which were fumigated with known concentrations of sulphur dioxide gas showed certain injuries which were characteristic for the species and for the age of the tissues involved. Leaves of dicotyledonous plants became spotted and mottled between the veins. Upon removal from the sulphur dioxide fumes, most species severely injured started to make recovery from all growing points.

The response of monocotyledonous leaves to severe dioxide fumigation varied from slight mottling or injured types with dilute gas to completely bleached leaves treated with high concentrations of gas.

Buckwheat was the most susceptible species discovered in the course of these investigations. With continuous exposure to the gas leaves were slightly injured in seven hours with 0·46 of one part of sulphur dioxide per million of air. In general, the injury to buckwheat leaves increased directly with concentration of the gas and the length of the fumigation period. The same trend was shown by fumigated barley, oats and rye, though they were not so susceptible as buckwheat. Barley was slightly injured in eight hours when exposed to 0·60 p.p.m., in four hours with 0·66 p.p.m., and in two hours with 0·80 p.p.m. Oats and rye treated in the same case with barley showed approximately the same amount of injury. Indications were obtained that the internal conditions of the plants at the time they are fumigated may control the entrance of sulphur dioxide and thereby affect the resistance of the plants. It appeared that the degree of turgidity of the leaves at the time they were fumigated was one of the most effective conditions. Results showed that wilted plants were more resistant than turgid ones. Plants fumigated at night showed more resistance than similar plants treated during the day.

**Observations on the Brown Heart Disease of Turnips.** *R. R. Hurst. Sci. Agric., Vol. 14, No. 12.*—About 1928 this disorder occasioned considerable financial loss to farmers in the province of Prince Edward Island. Brown heart may be found in turnips ranging in size from seedlings to large roots. On making a transverse cut through an infected turnip brown heart is readily recognised as a clearly defined brownish and mottled central area. The freshly cut surface of these turnips appears glassy or water-soaked. Turnips affected with brown heart have been found to be decidedly bitter to the taste, but this applies only to the discoloured tissues. Affected turnips when cooked were found to be distinctly woody. There was nothing to suggest that brown heart was of parasitic origin, and failure to isolate a pathogenic organism from the affected tissue has led to the conclusion that the disease is entirely of a physiological nature. No evidence has been obtained to show that the disease is due to the presence of a virus. In the experiments in 1922 at Charlottetown out of twenty varieties tested absolute freedom from brown heart was exhibited by only four strains.

An extensive survey of turnip fields throughout the province in 1932 showed that in general the amount of brown heart decreased as the applications of manure were increased, regardless of variations in the quantities and kinds of fertiliser used. In the entire absence of manure, brown heart was usually present in amounts ranging from 25 to 90 per cent. The date of seeding appeared to have some bearing on the development of brown heart, the most brown heart coming from the 2nd and 6th seedings, while the 4th and 5th seedings were practically free. No significant difference, however, has been determined experimentally with respect to seeding dates.

Hydrogen-ion concentration tests were made in connection with the field experiment, but the severity of brown heart did not appear to be correlated with soil reaction as expressed in pH values. It was observed that turnips from soil having the highest pH values were of a superior quality.

**The Transition from Woodland and Moorland to Grassland in the Spey Valley and Elsewhere.** *E. Wyllie Fenton. Jour. Ecology, 23,* 56-68, 1935.—Records of the changes in the vegetation that occur when woodland or moorland is replaced by grassland are generally lacking. An investigation of the Spey Valley, in which the Scots pine is the dominant tree, shows that with the gradual invasion of grass into the healthy growth beneath the pine trees, sheep's fescue is usually the first grass to gain dominance, followed by bent grasses, with sheep's fescue sub-dominant at first and Yorkshire fog, sweet vernal or crested dogstail afterwards. The grassland that develops from moorland follows the same sequence, but generally shows a slower transition in its early stages. Where the oak is the dominant tree the transition is less varied and prolonged. Where there is treading and grazing of stock, especially cattle, it may be speedier. The utilisation of land in the areas observed was sometimes injudicious, from lack of planning.

## SOILS

**The Influence of Artificial Fertilisers and of Farmyard Manure on the Fertility of the Soil.** *Lemmermann, Engel and Behrens. Zeit. Pf. Dung. u. Bodenk.,* 37, 5/6, 1935.—A review of the literature on this subject and the results of further experiments which have been carried out at Dahlem, Berlin, are given. Higher yields have been obtained with mineral fertilisers than with equal quantities of nutrients given in the form of farmyard manure and this has been traced to the greater availability of the nitrogen added in mineral form. Stress is laid on the importance of farmyard manure in providing supplies of humus and in maintaining the nitrogen reserves in the soil. The difficulties in maintaining fertility over a long period by means of artificial fertilisers alone are pointed out.

**On the Importance of a Suitable Nutrient Ratio for Plants.** *Lemmermann and Behrens. Zeit. Pf. Dung. u. Bodenk.,* 37, 5/6, 1935.—Results of previous experiments on the importance of balanced supplies of plant nutrients in the soil are summarised. Results of further experiments are given and in these it has been found that with oats the best results are obtained when the ratio of potash and phosphoric acid in the soil is greater than 1.

**On the Influence of Manuring on the Permeability of the Soil.** *Lemmermann and Behrens. Zeit. Pf. Dung. u. Bodenk.,* 37, 3/4, 1935.—A study has been made of the permeability of soils to which various manures have been added under laboratory and under field conditions. In soils which had been treated with various salt solutions in the laboratory it was found that a reduction in permeability followed the application of salts of sodium. Calcium chloride increased the permeability of alkaline soils and reduced that of acid soils. Potassium carbonate and magnesia had little effect on permeability. Differences in permeability were also found in soils which had been treated under field conditions. A reduction was found to follow continued treatment with nitrate of soda and with kainit. In an experiment at Lauchstädt farmyard manure was found to increase and lime to decrease the permeability of the soil.

**The Amphoteric Nature of Three Coastal Plain Soils : 1. In Relation to Plant Growth.** *Hester. Soil Sci.,* 39, 3, 1935.—Experiments have been conducted on three soils in the coastal plain of Virginia to study the effect of soil acidity on the growth of vegetables. Growth is markedly retarded when the soil conditions are very acid and this retardation is correlated with the appearance of aluminium in the drainage water. The addition of organic matter is found to suppress aluminium solubility and to enable crops to grow more satisfactorily under acid conditions in these soils.

**Sensitivity of the Potato Plant to Soil Aeration.** *Bushnell. Jour. Amer. Soc. Agron.,* 27, 4, 1935.—Experiments have been conducted to study the effects of applications of sand and of the introduction of ventilating tile lines on the yield of potatoes on silt loam and heavier soil types. The results show that increased yields are obtained when these soils are aerated.

## ANIMAL BREEDING

### *Cattle*

**Progeny Test and Individual Performance as Indicators of an Animal's Breeding Value.** *J. L. Lush.* 1935. *J. Dairy Sci., 18,* 1-19.—As usual Dr Lush strikes something fundamental when, in his second paragraph, he points out that a progeny test is not necessarily the full indication of the genetic constitution of the bull so tested. The majority of workers on this subject, including all in this country, have been inclined to attribute to the progeny test of the bull a greater degree of accuracy than that obtained from the cow's own record. Dr Lush points out that no fundamental distinction is really involved since the progeny test itself consists of some kind of an average of the phenotypic records of the offspring.

The present paper presents the results of an enquiry into the relative accuracy of the progeny test and the parent's own performance as indicators of the parent's real breeding value. An answer, accurate enough for practical purposes, can be presented in simple form. Dr Lush puts the problem as follows: Is a cow's own record, or the average record of *n* of her daughters, the more dependable indicator of the cow's own breeding value? To answer this question Dr Lush leads the readers into realms of higher mathematics, from which some illuminating deductions are made.

Dealing with the question as to whether it is advisable to test bulls on low-producing cows, he comes to the conclusion that such a plan would seldom yield information that was anything like worth the cost of getting it. If the sire and dam belonged to different breeds there would be increased probability of important misleading epistatic effects, which would probably preclude using for testers individuals of a breed developed for other purposes as, for example, the use of beef-bred cows for testing the breeding value of a dairy bull for milk and fat production.

For traits which the sire cannot express himself there is nothing but a pedigree estimate of the sire against which to compare the accuracy of a progeny test. Since a progeny test surpasses even the best pedigree estimate, it is more useful and more urgently needed for the sire than for the dam. However, such progeny tests will rarely tell as much about the sire as the available information correctly used will tell about a dam of nearly equal age. Enthusiasm over some such slogan as the current one that " the next best thing to a proved sire is the son of a proved sire " should not cause us to forget that such a son is one generation of mendelian segregation away from this sire, and that half of his inheritance comes from his dam, whose breeding value may usually be estimated more closely than that of his proved sire, if the available information is fully and fairly used.

Dr Lush concludes that to estimate the breeding value of an animal, the following are of major importance: pedigree, the performance of the female, and the progeny test. As fast as some selection is practised on one of these bases, the possibilities for further progress by additional selection on the same bases rapidly diminish, and correspondingly, increased attention should be given to one of the other methods.

**Virgin Heifers Secrete Milk after Injection.** *E. I. Evans,* 1934. *U.S.D.A. Year-book,* 360-363.—Careful investigation has shown that pregnancy is not necessary for the full development of the mammary gland and milk secretion, but that by injection of the proper materials virgin animals—male as well as female—can be made to elaborate and secrete milk. It appears that the hormone theelin is responsible for the extension of the duct system, and that this hormone, together with the corpusluteum hormone, stimulates complete mammary growth. It is here that the stimulus produced by the anterior lobe of the pituitary gland (a small gland about the size of a hazelnut, lying at the base of the brain) comes into play.

For some time the investigators of the United States Bureau of Dairy Industry were under the impression that their preparations of this lactation-stimulating hormone might be acting only as a stimulant to the animal's own pituitary. Recent experiments indicate that such is not the case. The point was settled by experimental surgical removal of a female dog's pituitary gland. The dog recovered from the operation, and in twenty-four hours was normal in every respect. Subsequent injection of the hormone caused copious milk secretion. As a result of this test it is supposed that the hormone is stimulating the mammary gland directly.

Many of the results were obtained in working with small animals and goats; but in an experiment with a virgin Jersey heifer the investigators were able to maintain an average of 15-18 lb. of milk daily for several months after they had ceased giving the injection. According to their pedigrees certain of the experimental cows of the Bureau of Dairy Industry were thought to have received an inheritance for levels of high production. Their performance, however, was disappointing. Accordingly, these cows were injected with extracts of the anterior pituitary. In some cases production increased from 25-30 per cent above the levels maintained immediately before injections were given. But these higher levels of production were not maintained after the injections were discontinued. Failure of the anterior pituitary to secrete proper amounts of its lactation-stimulating hormone is not the only cause for failure of higher production. It is, however, a major cause, and where it is lacking artificial injection can do the trick.

It only remains to be added that the expense of producing this hormone puts the possibility of its practical use out of the question.

**Comparison of Lactation and Yearly Records of Dairy Cattle.** *G. M. Harris, J. L. Lush and E. N. Schultz. Jour. Dairy Sci.*, 1934, *17*, 737-742.—Under the Milk Recording Scheme adopted by the Ministry of Agriculture for England, the cows are primarily measured on the amount of milk they produce in the calendar year, starting 1st October. Under the Scottish Milk Records Association, the cows are recorded on their lactation yield. In America the Cow Testing Associations usually work with yearly records, and these are, as in England, translated by Breed Societies into lactation records as required. The purpose of this study was to answer the question as to whether the lactation record is more accurate than the yearly record of the Cow Testing Association. In other words, does the lactation record tend to repeat itself more closely year after year, and is it thus the better criterion upon which to base the culling or selection of dairy cows ? Secondly, if the lactation record is more accurate, is this difference in accuracy sufficient to pay for the additional labour required in calculating this record from the yearly records available ?

In order to be effective for selection purposes, past production records of a cow must furnish a fairly accurate measure of what she can be expected to produce in the future. The true value of selection by the use of records is dependent, therefore, upon how closely these records tend to repeat themselves lactation after lactation, or year after year, as the case may be.

From the results of this study it may be concluded that the Cow Testing Association yearly record tends to repeat itself in succeeding years about as closely as does the lactation record. The authors, therefore, conclude that a general change to the lactation basis for selecting dairy cows, proving dairy sires, etc., will not lead to any material increase in accuracy. Such a change, they state, would be hard to justify if it entails any appreciable amount of additional expense or trouble.

In conclusion, they state that what is far more important is the conditions under which the records are made. They recommend that allowance for these conditions should be made wherever possible. The individual owner can do this to some extent, but the man who has only the production records, with no description of the conditions under which they were made, cannot even begin to make such allowances.

**Frequency of Milking as Affecting Milk and Butter-fat Yields of Jersey Cows.** *L. Copeland. Jour. Dairy Sci.*, 1934, *17*, 815-822.—When Jersey cows were milked three times daily there was a resulting increase of approximately 19 per cent in butter-fat and 21 per cent in milk yield. This increase in yield, due to milking three times daily, varies greatly with the producing ability of the animal on twice a day milking. High-producing cows show a smaller increase in yield when milked three times daily than do cows with a lower inherited producing ability. In view of this variation in the individuality of the cows, the writer does not recommend the use of a single factor for converting all records made with twice a day milking to a three times a day milking basis.

An analysis of the data presented here shows some interesting sidelights on the physiology of lactation. The fact that the lower yielders with twice a day milking made the bigger response is in almost direct contrast to popular opinion among many dairymen. It has been shown elsewhere that as the udder fills with milk, the pressure exerted by the milk tends to check secretion. This accounts for the fact that cows yield greater quantities of milk when milked oftener than twice a day. Yet, according to this reasoning, high-producing cows ought to show a greater increase than average-producing cows when they are milked three times daily. The writer also states that milking heifers three times daily results in a slightly greater development than when the records are made on twice a day milking. He comes to the conclusion that the mass testing of cows on twice a day milking will definitely differentiate between average cows and high-producing cows of the breed.

**Technique for Obtaining Spermatozoa for Physiological Dairy Studies and Artificial Insemination.** *F. W. Miller and E. I. Evans. Jour. Agric. Res.*, *48*, 941-947, 1934.—This is a useful review of the subject, and contains the results of further work which is of considerable practical importance.

## ANIMAL NUTRITION

**Nutritive Value of Pasture. II. The Composition and Nutritive Value of Winter Pasturage.** *H. E. Woodman and P. M. Oosthuizen. Jour. Agric. Sci.*, *24*, 574-597, 1934. —A study was made of the yield, composition and digestibility of pasture produced by unrestricted growth over the periods: (1) end of July 1932 to December 1932; (2) end of August 1932 to January 1933; (3) end of September 1932 to February 1933; and (4) end of October 1931 to March 1932. Both winters were mild and open and gave the most favourable conditions for such a study. The results were compared with those obtained for spring or summer herbage from the same pasture and of comparable height, stage of growth and botanical composition.

The July-December herbage, as compared with spring grass, was poorer in protein, lime, and phosphoric acid and richer in fibre and N-free extractives. It had a lower digestibility and nutritive value and had apparently undergone a considerable degree of lignification. The results indicate the necessity of taking into account not only stage of growth but also meteorological conditions as factors in determining composition and digestibility. The depressing influence of winter conditions appeared to be less pronounced on the composition and digestibility of the short leafy herbage (September-February) than on the longer, more advanced grass (July-December).

Under East Anglian climatic conditions it would be necessary to discontinue the grazing of pastures at the end of July if an adequate amount of herbage for grazing during the winter months is to be obtained. The water herbage appeared to be definitely unpalatable to the experimental sheep, the browning due to frost being an important factor in this respect.

**Pig-feeding Experiment with Potatoes and with Dried Skimmed Milk as Protein Supplement.** *E. Crasemann. Ber. d. landwirtsch. Schule Strickhof, Zürich,* 1933-34, 110-114.—The experiment was carried out on improved "Landschwein" pigs. Steamed potatoes were fed *ad lib.* with 500 g. oats, 500 g. dried skimmed milk, 200 g. vegetable refuse and 20 g. calcium phosphate. As sole protein supplement dried skimmed milk did not give a rate of gain in weight above the average for the breed and was uneconomic.

**Fattening Young Leghorn and Other Cockerels.** *O. Mascagni. Riv. Zootec.*, 1933, 11, 495-506.—For fattening young cockerels cheaply, at the same time obtaining a high quality flesh, the author recommends intensive feeding in confinement. The ration should contain at first 18-20 per cent protein, later reduced to 16-17 per cent, and should be as free as possible from non-digestible substances such as cellulose.

**Hopper-** *versus* **Litter-feeding of Grain.** *J. H. Martin and W. M. Inkso. (Jr.). Poultry Sci*, 1934, *13*, 380.—White Leghorns, Barred Plymouth Rocks and Rhode Island Reds were used for comparing hopper-feeding of grain *ad lib.* with the more orthodox method of feeding it in the litter. There was no significant difference in egg production under the two methods except perhaps in the case of the Barred Rocks where litter-feeding was superior. In nearly every case, however, more grain and less mash were consumed by the hopper-fed birds, and they also required rather more food per dozen eggs laid.

**Wheat and Wheat By-products for Laying Hens.** *W. C. Tully. South Dakota State Coll. Agric. and Mech. Arts Bull., No.* 284. *May* 1934, p. 8.—Thirty per cent ground wheat was just as satisfactory for egg production as 15 per cent each of bran and flower middlings in the mash used. Similarly 15 per cent wheat, replacing either 15 per cent bran or 15 per cent middlings, did not affect egg yield. The tests were confined to laying pullets.

**Effect of Artificial Light on Winter Egg Production.** *N. Tortorelli. Riv. Zootec.*, 1934, *11*, 448-458.—Thirty minutes artificial light daily (8 to 8.30 p.m.) with a supplementary meal (25 g. cereal per hen) quintupled the egg yield, without detriment to the subsequent egg production.

## ECONOMICS

**Jour. of the Agric. Economics Soc.**, *Vol.* 3, *No.* 4.—Three papers are contained in this report of the Society's Conference held in London, 11th and 12th December 1934.—"The Development of Danish Agricultural Production and Export during the last Two Generations and the Effect of the Present Trade Restrictions on the National Economy of Denmark," by S. Sörensen (Agricultural Advisor to the Danish Government); "The Place of the Poultry Industry in the National Economy," by D. H. Dinsdale; and "Agriculture in the South-West of Scotland—Past and Present Trends," by J. A. Gilchrist.

After a discussion of the development of live-stock production in Denmark, the profitableness of Danish farming, the influence of trade restrictions on the export of agricultural products from Denmark, and recent relief measures adopted by the Danish Government, Mr Sörensen's paper concludes as follows: "It has become obvious that the present agricultural crisis, unlike that of the eighties and nineties, cannot be overcome by increased production. Much against their will, Danish farmers are forced to slow down production, buying less fertilisers, less grain and feeding stuffs, and reducing the number of live stock. If such a process is carried beyond a certain point it must inevitably result in breaking down the present intensive system of agriculture in Denmark. For this reason, therefore, it is to be hoped that the world economic situation will make it possible for Denmark to maintain her considerable export of high-class agricultural products, particularly to this country."

Mr Dinsdale notes that whereas in 1924-25 the estimated value of poultry and eggs sold off agricultural holdings in England and Wales was £14,570,000 or 9·45 per cent of the value of all live stock and live-stock produce, in less than ten years (1932-33) it had increased to £20,750,000 or 15·8 per cent of total live-stock sales. It is suggested that the poultry industry creates a direct demand for at least 90,000 full-time men in addition to those employed in ancillary industries. The analysis of the accounts of commercial egg farms in the Northern Advisory Province showed the average annual profit per laying bird to be 5s. in 1931-32, 3s. in 1932-33, and 2s. 7½d. in 1933-34.

Declining acreage of arable land, cereals and turnips; marked increases in dairy herds, horticultural production and, particularly, numbers of poultry; continuous decline in the numbers of women and girls in agricultural employment—these are some of the more pronounced post-war tendencies discussed by Mr Gilchrist in his paper dealing with the south-west of Scotland.

**Aspects of Agricultural Reconstruction. A Symposium.** *Agric. Prog., Vol.* 12. 1935. 5s.—In this group of articles six authorities discuss in turn the Milk Marketing Scheme (Prof. Ashby); the Potato Marketing Scheme (Miss Cohen); the Pigs Marketing Scheme (Dr Murray); the Wheat Quota (Mr Orwin); the Cattle Industry (Emergency Provisions) Act, 1934 (Prof. Scott Watson); and Agricultural Reconstruction in the United States (Mr Geoff. Crowther). In the first five the writers deal with the circumstances prevailing prior to the schemes and the conditions which these imposed on the character of the schemes; the measure of success attained; and the problems that remain.

Professor Ashby concludes that, on the whole, in the trial period of 1933-34, the Milk Marketing Scheme (England and Wales) worked well, but a number of problems of present and future policy remain for solution. The more immediate of these include: (1) differential prices due to the effect of transport deductions from the pool price; (2) the effect of a national standard price on production in areas of low-producing costs; (3) the collection of the levies on producer-retailers and the tendencies for these levies to increase; (4) the re-arrangement of distribution and utilisation of milk in the face of vested interests in distribution and manufacture; (5) the question whether unlimited expansion of milk production in this country can be allowed whilst the Board has to be responsible for all losses incurred on manufactured milk.

The main achievements of the Potato Marketing Board are stated by Miss Cohen to have been: (1) the provision of a better system of market intelligence; (2) the collection of a larger volume of information; (3) greater stability of prices; (4) effective interference to prevent market collapse. The Board has concentrated on eliminating inefficient marketing methods, and this will continue to be its main function in the future.

According to Dr Murray the objects of the Pigs Marketing Scheme have proved in practice to be somewhat elusive. Bacon prices have shown greater stability but have not been higher in relation to feeding costs than previously, and have, in fact, been lower. The main hopes of higher prices have not been realised owing to the conditions of demand for bacon. Again increased bargaining power has not yet achieved any reduction in the margin between consumers' and producers' prices. The position of the curers seems relatively as strong as ever. On the other hand the payment for pigs on a quality basis has reacted to the benefit of the producer. Unless there has been, or is, an accompanying reduction in production costs the prospects of maintaining the present level of bacon production are not bright.

General approval of the principles and operation of the Wheat Act is given by Mr Orwin. The Act represents no more than a decision by the Government to find some method of helping a depressed section of the arable farmers of the country. This it has accomplished with a minimum of cost to producers and without extending production to an uneconomic extent.

The machinery for the temporary assistance of beef producers is outlined by Professor Watson who comments as follows on current criticisms: "It is probably true that the subsidy has not been sufficient to raise producers' receipts above production costs, but the claim that the payment of the subsidy has depressed the market price will not bear examination." Professor Watson agrees that the carcase percentage is probably too low and that the flat rate gives a relative advantage to producers of poor quality beef. On the whole, the administrative difficulties have been much less serious than many people anticipated.

**The Economic Value of Poultry on the Farm.** *A. G. Ruston. Jour. of the Royal Agric. Soc. of England. Vol.* 95. 1934.—Poultry records analysed at the University of Leeds show that during a period of agricultural depression the average profit per bird was as follows:

| Year | Average Surplus per bird s. | d. | Year | Average Surplus per bird s. | d. |
|---|---|---|---|---|---|
| 1919-20 | 17 | 6 | 1927-28 | 4 | 2 |
| 1920-21 | 14 | 2 | 1928-29 | 5 | 7 |
| 1921-22 | 9 | 9 | 1929-30 | 6 | 9 |
| 1922-23 | 3 | 0 | 1930-31 | 4 | 11 |
| 1923-24 | 3 | 10 | 1931-32 | 5 | 0 |
| 1924-25 | 4 | 6 | 1932-33 | 3 | 10 |
| 1925-26 | 4 | 8 | 1933-34 | 3 | 0 |
| 1926-27 | 3 | 8 | | | |

Over the same series of years 30 head of poultry have brought in the same net return as one cow.

# STATISTICS

## PRICES OF AGRICULTURAL PRODUCE, FEEDING STUFFS AND FERTILISERS IN MARCH, APRIL AND MAY 1935

### Live Stock : Monthly Averages of Prices at certain representative Scottish Markets.

(*Compiled from Returns received from the Department's Market Reporters*)

| Description | March | | | April | | | May | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality |
| FAT STOCK :— | | | | | | | | | |
| *Cattle— | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* | per cwt.<br>*s. d.* |
| Aberdeen-Angus .. .. | 42 1 | 38 1 | 36 8 | 42 6 | 38 5 | 37 1 | 43 7 | 39 6 | 37 4 |
| Cross-bred (Shorthorn) | 38 9 | 35 6 | 29 4 | 39 5 | 35 11 | 28 11 | 40 11 | 37 2 | 29 2 |
| Galloway .. .. | 38 6 | 35 7 | .. | 38 9 | 35 11 | .. | 40 8 | 37 [illegible] | .. |
| Ayrshire .. .. | 38 5 | 35 0 | 31 0 | 38 1 | 35 2 | 31 5 | 38 2 | 35 1 | .. |
| Blue Grey .. .. | 42 3 | 39 2 | 39 0 | 41 7 | 39 8 | .. | 43 5 | 40 8 | 38 10 |
| Highland .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* |
| †Veal Calves .. .. | 13 | 3½ | .. | 13 | 3½ | .. | 14 | 3½ | .. |
| †Sheep— | Hoggs under 60 lb. per lb.<br>*d.* | 60 lb. and upw'd. per lb.<br>*d.* | Ewes per lb.<br>*d.* | Hoggs under 60 lb. per lb.<br>*d.* | 60 lb. and upw'd. per lb.<br>*d.* | Ewes per lb.<br>*d.* | Hoggs under 60 lb. per lb.<br>*d.* | 60 lb. and upw'd. per lb.<br>*d.* | Ewes per lb.<br>*d.* |
| Cheviot .. .. | 12¾ | .. | 8¼ | 13 | 12½ | 8 | 12 | 11½ | 7¾ |
| Half-bred .. .. | 12 | 11¼ | 8¼ | 12 | 11½ | 8½ | 11½ | 11 | 7½ |
| Blackface .. .. | 12¼ | 11 | 7¾ | 12¼ | 11 | 7¾ | 11½ | 10½ | 7½ |
| Greyface .. .. | 12¼ | 11¼ | 8 | 12¼ | 11¼ | 8 | 11½ | 10¾ | 7½ |
| Down Cross .. .. | 12¼ | 11 | 9 | 12¼ | 11¼ | 9 | 11¾ | 10¾ | 8¼ |
| †Pigs— | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* | per stone<br>*s. d.* |
| Bacon Pigs .. .. | 9 0 | 7 10 | .. | 8 10 | 7 9 | .. | 8 7 | 7 7 | .. |
| Porkers .. .. | 9 9 | 8 7 | .. | 9 8 | 8 6 | .. | 9 5 | 8 3 | .. |

* Live weight.

† Estimated dressed carcase weight.

## LIVE STOCK : Monthly Averages of Prices (per head) at certain representative Scottish Markets—(*continued*).

| DESCRIPTION | MARCH | | | APRIL | | | MAY | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality |
| STORE STOCK :— | | | | | | | | | |
| CATTLE— | | | | | | | | | |
| Aberdeen-Angus: | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. |
| Yearlings .. .. | 13 18 | 10 12 | 7 17 | 14 18 | 11 13 | 8 19 | 14 13 | 11 12 | 9 0 |
| Two-year-olds .. | 16 14 | 14 12 | .. | 18 7 | 14 18 | 11 5 | 18 11 | 15 3 | 11 2 |
| Cross-bred (Shorthorn) | | | | | | | | | |
| Yearlings .. .. | 13 8 | 9 19 | 8 10 | 13 11 | 10 9 | 8 4 | 13 14 | 10 13 | 8 12 |
| Two-year-olds .. | 16 12 | 13 11 | .. | 17 1 | 14 0 | 10 10 | 18 0 | 14 8 | 11 4 |
| Galloway : | | | | | | | | | |
| Yearlings .. .. | 12 0 | 10 0 | .. | 12 19 | 10 13 | .. | 12 14 | 10 8 | .. |
| Two-year-olds .. | .. | .. | .. | 19 13 | 15 10 | .. | 16 17 | 13 8 | .. |
| Ayrshire : | | | | | | | | | |
| Yearlings .. .. | .. | .. | .. | 11 0 | .. | .. | 12 1 | 10 18 | 10 5 |
| Two-year-olds .. | .. | .. | .. | .. | .. | .. | 15 13 | .. | .. |
| Blue Grey : | | | | | | | | | |
| Yearlings .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Two-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Highland : | | | | | | | | | |
| Yearlings .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Two-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Three-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| DAIRY COWS— | | | | | | | | | |
| Ayrshire : | | | | | | | | | |
| In milk .. .. | 25 8 | 18 4 | 12 15 | 25 11 | 18 10 | 12 16 | 24 5 | 17 10 | 12 6 |
| Calvers .. .. | 25 10 | 18 18 | 14 2 | 26 5 | 19 9 | 14 11 | 24 14 | 19 3 | 13 18 |
| Shorthorn Cross : | | | | | | | | | |
| In milk .. .. | 26 6 | 19 9 | 13 18 | 25 11 | 18 13 | 15 5 | 24 15 | 17 14 | 15 8 |
| Calvers .. .. | 24 17 | 17 5 | 13 9 | 23 6 | 16 13 | 13 13 | 22 18 | 16 12 | 13 7 |
| SHEEP— | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| Cheviot Hoggs .. | 42 2 | 29 4 | .. | 38 7 | 27 4 | .. | 31 5 | 24 11 | .. |
| Half-bred Hoggs .. | 58 7 | 45 9 | 36 0 | 54 6 | 41 4 | 32 0 | 49 10 | 38 7 | 30 10 |
| Blackface Hoggs .. | 26 10 | 20 11 | .. | 27 2 | 21 0 | 17 2 | 30 0 | 22 10 | 16 8 |
| Greyface Hoggs .. | 45 6 | 34 2 | 31 9 | 42 9 | 33 4 | 28 9 | 40 8 | 31 0 | .. |
| Down Cross Hoggs | 53 5 | 48 0 | .. | 43 3 | .. | .. | .. | .. | .. |
| PIGS— | | | | | | | | | |
| (6 to 10 weeks old) | 31 1 | 19 10 | .. | 30 11 | 20 0 | .. | 30 2 | 19 10 | .. |

## Dead Meat: Monthly Average Prices at Dundee, Edinburgh and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| Description | Quality | March | | | April | | | May | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Dundee | Edinburgh | Glasgow | Dundee | Edinburgh | Glasgow | Dundee | Edinburgh | Glasgow |
| **Beef**:— | | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* |
| Home-fed— | | | | | | | | | | |
| Bullock or Heifer .. | 1 | 6¾ | 6¼ | 7⅝ | 6⅝ | 6¼ | 7½ | 6¾ | 6¾ | 8 |
| | 2 | 6⅛ | .. | 6⅞ | 6 | .. | 6¾ | 6¼ | .. | 6¾ |
| Bull .. .. .. | 1 | 5½ | 4⅞ | 5½ | 5½ | 4⅞ | 5½ | 5½ | 5 | 5½ |
| | 2 | 4¾ | .. | 4½ | 4⅝ | .. | 4½ | 4½ | .. | 4½ |
| Cow .. .. .. | 1 | 4½ | 4¾ | 5⅜ | 4½ | 4⅞ | 5 | 4¾ | 4⅞ | 5 |
| | 2 | 4 | .. | 4 | 3⅝ | .. | 4 | 3¾ | .. | 4 |
| Irish— | | | | | | | | | | |
| Bullock or Heifer .. | 1 | .. | .. | 7 | .. | .. | 7 | .. | .. | 7¼ |
| | 2 | .. | .. | 6 | .. | .. | 6 | .. | .. | 6 |
| Argentine Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | 4¼ | 4¼ | .. | 4⅜ | 4¼ | .. | 4½ | 4½ | .. |
| | 2 | .. | 3¾ | .. | .. | 3¾ | .. | .. | 4⅛ | .. |
| Fore ,, .. | 1 | 3¾ | 3¾ | .. | 3½ | 3⅝ | .. | 3⅝ | 3¾ | .. |
| | 2 | .. | 3⅜ | .. | .. | .. | .. | .. | 3½ | .. |
| Argentine Chilled— | | | | | | | | | | |
| Hind Quarters .. | 1 | 5⅞ | 6⅛ | 5½ | 5⅞ | 6 | 5¾ | 6½ | 7 | 6⅝ |
| | 2 | .. | 5⅜ | 5 | .. | 5⅜ | 5¼ | .. | 6⅜ | 5⅞ |
| Fore ,, .. | 1 | 3⅞ | 4⅛ | 3⅝ | 3¾ | 3⅞ | 3⅜ | 4 | 4¼ | 3⅞ |
| | 2 | .. | 3⅜ | 3⅜ | .. | 3⅜ | 3¼ | .. | 3⅝ | 3¼ |
| Australian Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | .. | .. | 4 | .. | .. | 4 | .. | .. | 4 |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Crops .. .. | 1 | .. | .. | 3⅝ | .. | .. | 3⅝ | .. | .. | 3⅜ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| New Zealand Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | .. | .. | 4 | .. | .. | 4 | .. | .. | 4 |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Fore ,, .. | 1 | .. | .. | 3¼ | .. | .. | 3¼ | .. | .. | 3⅛ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **Mutton**:— | | | | | | | | | | |
| Hoggs, Blackface .. | under 60 lb. | 11¾ | 11½ | 12¼ | 12½ | 11½ | 12⅛ | 11¼ | 11⅛ | 11¼ |
| | 60 lb. & over | 10¾ | .. | 11¾ | 11⅝ | .. | 11½ | 10 | .. | 11 |
| ,, Cross .. | under 60 lb. | 11¾ | 11½ | 12¼ | 12½ | 11½ | 12⅛ | 11¼ | 11⅛ | 11¼ |
| | 60 lb. & over | 10¾ | .. | 11¾ | 11⅝ | .. | 11½ | 10 | .. | 11 |
| Ewes, Cheviot .. | 1 | .. | 7¾ | 8⅛ | .. | 7⅜ | 8⅜ | .. | 7⅛ | 8⅜ |
| | 2 | .. | .. | 7⅞ | .. | .. | 8⅛ | .. | .. | 8 |
| ,, Blackface .. | 1 | 8⅜ | 7¾ | 8⅛ | 9⅛ | 7⅜ | 8½ | 8⅝ | 7⅛ | 8⅜ |
| | 2 | 7⅞ | .. | 7⅞ | 8⅜ | .. | 8⅛ | 8⅛ | .. | 8 |
| ,, Cross .. .. | 1 | 6 | 7¾ | 8⅛ | 6½ | 7⅜ | 8⅜ | 6 | 7⅛ | 8¼ |
| | 2 | 5 | .. | 7⅞ | 5½ | .. | 8 | 5 | .. | 7⅞ |
| Argentine Frozen .. | 1 | .. | .. | 4 | .. | .. | 4 | .. | .. | 3½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Australian ,, .. | 1 | .. | 5¼ | 4 | .. | 5 | 4 | .. | 4⅝ | 3½ |
| | 2 | .. | 3½ | .. | .. | 4¼ | .. | .. | 3⅝ | .. |
| New Zealand ,, .. | 1 | .. | .. | 4¾ | .. | .. | 4¾ | .. | .. | 3¾ |
| | 2 | .. | .. | 4¼ | .. | .. | 4 | .. | .. | 3¼ |
| **Lamb**:— | | | | | | | | | | |
| Home-fed .. .. | 1 | .. | .. | 12¾ | 16 | 15 | 13¾ | 14⅝ | 13⅞ | 14½ |
| | 2 | .. | .. | 12 | 15 | .. | 11⅞ | .. | .. | .. |
| New Zealand Frozen | 1 | .. | 7⅜ | 7½ | .. | 7⅛ | 7⅜ | .. | 7⅛ | 6⅝ |
| | 2 | .. | 6¾ | 7 | .. | 6⅝ | 7 | .. | 6¾ | .. |
| Australian ,, .. | 1 | .. | .. | 6⅞ | .. | .. | 6⅝ | .. | .. | 5¾ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Argentine .. .. | 1 | .. | .. | 6⅞ | .. | .. | 6⅝ | .. | .. | 5½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | | *per cwt*<br>*s.* *d.* | *per cwt*<br>*s.* *d.* | *per cwt*<br>*s.* *d.* | *per cwt.*<br>*s.* *d.* | *per cwt*<br>*s.* *d.* | *per cwt.*<br>*s.* *d.* | *per cwt.*<br>*s.* *d.* | *per cwt.*<br>*s.* *d.* | *per cwt*<br>*s.* *d.* |
| **Pork**:— | | | | | | | | | | |
| Home-fed .. .. | 1 | 84 0 | 77 7 | 79 4 | 80 6 | 78 7 | 79 4 | 75 7 | 73 1 | 79 4 |
| | 2 | 51 4 | .. | 70 0 | 56 0 | .. | 70 0 | 56 0 | .. | 70 0 |
| Imported .. .. | 1 | .. | .. | 60 8 | .. | .. | 60 8 | .. | .. | 60 8 |

(*Compiled from Returns received from the Department's Market Reporters*)

## EGGS: Monthly Average Wholesale Prices at Aberdeen, Kilmarnock, Lanarkshire and Glasgow.

| DESCRIPTION | WEIGHT PER 120 | QUALITY | MARCH | APRIL | MAY |
|---|---|---|---|---|---|
| | *lb.* | | *s. d.* | *s. d.* | *s. d.* |
| **ABERDEEN—** | | | | | |
| Country .. .. per doz. | .. | 1 | 0 9½ | 0 8½ | 0 9¼ |
| | .. | 2 | 0 9 | .. | .. |
| Duck .. .. ,, | .. | 1 | 0 10¼ | .. | .. |
| | .. | 2 | 0 9¼ | .. | .. |
| **KILMARNOCK—** | | | | | |
| Country (ungraded) per doz. | .. | 1 | 0 11¼ | 0 9½ | 0 10¾ |
| **LANARKSHIRE—** | | | | | |
| Country "Standard" per doz. | .. | 1 | 1 2 | 1 0¼ | 1 0¾ |
| **GLASGOW—** | | | | | |
| National Mark— | | | | | |
| "Special" .. per doz. | .. | .. | 1 0¼ | 0 10¾ | 0 11¾ |
| "Standard" .. ,, | .. | .. | 0 11¾ | 0 10¼ | 0 11¼ |
| "Medium" .. ,, | .. | .. | 0 10½ | 0 9¼ | 0 10 |
| ,, "Special" .. per 120 | .. | .. | 10 3 | 9 0 | 9 10 |
| "Standard" .. ,, | .. | .. | 9 9 | 8 5 | 9 4 |
| "Medium" .. ,, | .. | .. | 8 11 | 7 8 | 8 4 |
| Northern Ireland ,, | 17 | .. | 9 10 | 9 2 | 10 0 |
| ,, ,, | 15½ | .. | 9 3 | 8 5 | 9 3 |
| ,, ,, | 14 | .. | 8 7 | 7 6 | 8 0 |
| ,, (Duck) ,, | .. | 1 | 10 9 | 9 0 | 8 3 |
| Irish Free State .. ,, | 16 | .. | 8 11 | 8 1 | 8 5 |
| ,, .. ,, | 15 | .. | 8 7 | 7 8 | 8 0 |
| ,, .. ,, | 14 | .. | 7 10 | 7 0 | 7 4 |
| ,, (Duck) | .. | 1 | 9 10 | 8 6 | 7 9 |
| Danish .. .. ,, | 15½ | .. | 8 8 | 7 7 | 7 11 |
| ,, .. .. ,, | 14 | .. | 7 9 | 7 1 | 7 5 |
| Polish (ungraded) ,, | .. | 1 | 6 2 | 6 1 | 5 10 |
| ,, ( ,, ) ,, | .. | 2 | 5 3 | 5 1 | .. |
| Dutch .. .. ,, | 15½ | .. | 8 0 | 7 2 | 7 7 |
| Swedish .. .. ,, | 15½ | .. | .. | 7 0 | 7 7 |
| ,, .. .. ,, | 14 | .. | .. | 6 6 | 6 11 |

## PROVISIONS: Monthly Average Wholesale Prices (per cwt.) at Glasgow.

| DESCRIPTION | QUALITY | MARCH | APRIL | MAY |
|---|---|---|---|---|
| | | *s. d.* | *s. d.* | *s. d.* |
| **BUTTER—** | | | | |
| Scottish Creamery (unsalted) .. | 1 | 108 6 | 103 3 | 98 5 |
| Irish Creamery .. .. .. | 1 | .. | 83 0 | 81 5 |
| Australian .. .. .. | 1 | 79 9 | 79 3 | 80 5 |
| | 2 | 78 6 | 78 0 | .. |
| Danish .. .. .. | 1 | 110 0 | 103 9 | 96 10 |
| ,, (unsalted) .. .. | 1 | 113 0 | 106 9 | 99 10 |
| New Zealand .. .. .. | 1 | 81 9 | 81 3 | 84 5 |
| | 2 | 80 0 | 79 0 | .. |
| ,, (unsalted) .. .. | 1 | 84 9 | 84 3 | 87 5 |
| Swedish .. .. .. | 1 | 97 6 | 93 6 | 88 2 |
| Latvian .. .. .. | 1 | 88 6 | 83 3 | 79 2 |
| **CHEESE—** | | | | |
| Cheddar .. .. .. .. | 1 | 75 0 | 75 0 | 75 0 |
| | 2 | 52 0 | 48 2 | 46 5 |
| Cheddar Loaf .. .. .. | 1 | 76 0 | 72 0 | 72 0 |
| | 2 | 70 0 | 64 0 | 60 0 |
| Dunlop .. .. .. | 1 | 60 0 | 60 0 | 60 10 |
| | 2 | 50 0 | 48 6 | 47 0 |
| Canadian .. .. .. | 1 | 62 0 | 64 0 | 64 0 |
| | 2 | 58 0 | .. | .. |
| New Zealand (Coloured) .. | 1 | 50 0 | 50 0 | 49 0 |
| ,, (White) .. .. | 1 | 50 0 | 50 0 | 49 0 |
| **HAMS**—Irish (Smoked) .. .. | 1 | 152 0 | 162 0 | 170 0 |
| | 2 | 142 0 | 152 0 | 160 0 |
| American (Short Cut, Green) .. | 1 | 90 0 | 95 0 | 98 0 |
| Canadian (Long Cut, ,, ) .. | 1 | 94 0 | 96 6 | 98 0 |
| **BACON**—Ayrshire (Rolled) .. | 1 | 116 8 | 116 8 | 117 7 |
| | 2 | 112 0 | 112 0 | .. |
| English Wiltshire (Green) .. | 1 | 100 0 | 103 0 | 107 5 |
| | 2 | 93 0 | 96 0 | .. |
| ,, (Dried or Smoked) .. | 1 | 104 0 | 107 0 | 109 5 |
| | 2 | 101 0 | 104 0 | .. |
| Irish (Green, Wiltshire Style) .. | 1 | 94 6 | 97 0 | 99 5 |
| | 2 | 89 6 | 92 0 | 96 5 |
| ,, (Dried or Smoked) .. | 1 | 98 6 | 101 0 | 103 5 |
| | 2 | 93 6 | 96 0 | 98 10 |
| ,, (Long Clear) .. .. | 1 | 105 6 | 108 0 | 110 5 |
| | 2 | 103 6 | 106 0 | 108 5 |
| Canadian Sides (Green) .. | 1 | 78 0 | 81 0 | 87 0 |
| Danish Sides .. .. .. | 1 | 93 0 | 96 0 | 101 2 |
| Dutch (Green, Wiltshire Style) | 1 | 87 0 | 90 0 | 94 5 |
| **LARD**—American .. .. | 1 | 69 0 | 65 9 | 63 5 |

## FRUIT AND VEGETABLES : Monthly Average Wholesale Prices at Glasgow.

*(Compiled from Returns received from the Department's Market Reporter)*

| DESCRIPTION | | QUALITY | MARCH | APRIL | MAY |
|---|---|---|---|---|---|
| FRUIT :— | | | | | |
| Apples— | per | | s. d. | s. d. | s. d. |
| British Cooking | .. cwt. | 1 | 13 6 | .. | .. |
| American .. | .. case.† | 1 | 11 1 | 11 9 | .. |
| Australian .. | .. „ † | 1 | .. | 16 6 | 11 8 |
| South African .. | .. „ † | 1 | .. | 14 6 | .. |
| Pears— | | | | | |
| South African .. | .. box.‖ | 1 | 13 6 | 15 0 | .. |
| Australian .. | .. box.‖ | 1 | .. | .. | 13 6 |
| VEGETABLES :— | | | | | |
| Beet .. .. | .. cwt. | 1 | 5 9 | 5 9 | 5 0 |
| Brussels Sprouts | „ | 1 | 16 0 | .. | .. |
| Cabbage— | | | | | |
| Coleworts .. | .. dozen. | 1 | 1 0 | 1 0 | 1 0 |
| Red .. .. | .. „ | 1 | 2 9 | 3 0 | .. |
| Savoy .. .. | .. „ | 1 | 1 7 | 1 6 | . |
| Carrots— | | | | | |
| British .. .. | .. cwt. | 1 | 5 0 | 5 0 | 5 7 |
| Dutch .. .. | dozen bunches | 1 | .. | .. | 8 8 |
| Cauliflowers— | | | | | |
| Broccoli, Cornish | .. dozen. | 1 | 4 8 | 4 9 | 4 2 |
| Other British .. | .. „ | 1 | 3 6 | 3 6 | 3 11 |
| French .. .. | .. „ | 1 | 4 11 | 5 2 | .. |
| Celery .. .. | .. bunch. | 1 | 1 2 | .. | .. |
| Cucumbers .. | .. dozen. | 1 | 7 9 | 6 3 | 5 0 |
| Greens .. .. | .. bunch. | 1 | 0 5¾ | 0 6 | .. |
| Leeks .. .. | dozen bunches. | 1 | 2 6 | 2 6 | 3 5 |
| Lettuce— | | | | | |
| Cabbage .. | .. dozen. | 1 | 2 5 | 2 1 | 2 7 |
| Onions— | | | | | |
| *Spring* .. .. | .. bunch. | 1 | 0 4¼ | 0 4¼ | 0 4½ |
| *Dutch* .. .. | .. bag.** | 1 | 7 9 | 4 6 | .. |
| *Egyptian* .. | .. „ § | 1 | 11 0 | 8 0 | 8 11 |
| *Valencia* .. | .. case.†† | 1 | 10 0 | 10 3 | 11 2 |
| Parsley .. .. | .. cwt. | 1 | 9 6 | 10 0 | 10 0 |
| Parsnips .. .. | .. „ | 1 | 7 9 | 6 3 | 6 0 |
| Radishes .. .. | dozen bunches. | 1 | 1 10 | 1 11 | 1 10 |
| Rhubarb .. .. | .. cwt. | 1 | 26 6 | 10 6 | 2 7 |
| Spinach .. .. | .. stone. | 1 | 4 5 | 4 0 | 4 0 |
| Tomatoes— | | | | | |
| Scottish .. | .. lb. | 1 | .. | .. | 1 5 |
| Canary .. | .. „ | 1 | 0 2½ | 0 3½ | 0 4¾ |
| Channel Islands | .. „ | 1 | .. | 1 9 | 1 0 |
| Turnips .. | .. cwt. | 1 | 1 9 | 1 11 | 2 7 |

† 40 lb. (approx.). †† 9 stone (approx.). ** 7½ stone (approx.).
‖ 46 lb. (approx.). § cwt. (approx.).

## POTATOES: Monthly Average Wholesale Prices (per ton) at Aberdeen, Dundee, Edinburgh and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| MARKET | Quality | FIRST EARLIES | SECOND EARLIES | LATE VARIETIES: RED SOILS: Golden Wonder | LATE VARIETIES: RED SOILS: Other | LATE VARIETIES: OTHER SOILS: Golden Wonder | LATE VARIETIES: OTHER SOILS: Other |
|---|---|---|---|---|---|---|---|
| | | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| **MARCH** | | | | | | | |
| Aberdeen .. | 1 | .. | .. | .. | .. | 4 12 6 | 3 15 0 |
| Dundee .. | 1 | .. | .. | .. | .. | 4 5 0 | 2 15 0 |
| Edinburgh .. | 1 | .. | .. | .. | .. | .. | 3 10 0 |
| Glasgow .. | 1 | .. | 2 15 0 | .. | .. | 4 10 0 | 3 6 11 |
| **APRIL** | | | | | | | |
| Aberdeen .. | 1 | .. | .. | .. | .. | 4 12 6 | 3 10 8 |
| Dundee .. | 1 | .. | .. | .. | .. | 4 10 8 | 3 5 11 |
| Edinburgh .. | 1 | .. | .. | .. | .. | .. | 3 10 0 |
| Glasgow .. | 1 | .. | 3 0 8 | .. | .. | 4 13 9 | 3 16 3 |
| **MAY** | | | | | | | |
| Aberdeen .. | 1 | .. | .. | .. | .. | 4 15 6 | 4 5 6 |
| Dundee .. | 1 | .. | .. | .. | .. | 5 19 0 | 4 10 0 |
| Edinburgh .. | 1 | .. | .. | .. | .. | 7 6 8 | 4 12 0 |
| Glasgow .. | 1 | .. | 3 19 0 | .. | .. | 5 6 0 | 4 18 0 |

## ROOTS, HAY, STRAW, AND MOSS LITTER: Monthly Average Prices (per ton) at Aberdeen, Dundee, Edinburgh and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| MARKET | Quality | ROOTS: Carrots | ROOTS: Yellow Turnips | ROOTS: Swedes | HAY: Rye Grass and Clover | HAY: Timothy | STRAW: Wheat | STRAW: Barley | STRAW: Oat | MOSS LITTER |
|---|---|---|---|---|---|---|---|---|---|---|
| | | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| **MARCH** | | | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 67 6 | .. | .. | .. | 40 0 | .. |
| †Dundee .. | 1 | .. | .. | ø18 0 | 100 0a<br>90 0b | .. | 46 3 | .. | 66 3 | .. |
| ‖Edinburgh .. | 1 | .. | .. | .. | 85 0a<br>82 6b | .. | 27 6 | 24 5 | 30 0 | .. |
| *a*Glasgow .. | 1 | .. | .. | .. | 85 0 | 90 0 | 35 0 | .. | 50 0 | 34 0c |
| **APRIL** | | | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 70 0 | .. | .. | .. | 38 4 | .. |
| †Dundee .. | 1 | .. | .. | ø19 6 | 100 0a<br>90 0b | .. | 50 0 | .. | 67 6 | .. |
| ‖Edinburgh .. | 1 | .. | .. | .. | 85 0a<br>82 6b | .. | 27 6 | 23 9 | 31 3 | .. |
| *a*Glasgow .. | 1 | .. | .. | .. | 85 0 | 90 0 | 35 0 | .. | 50 0 | 34 9c |
| **MAY** | | | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 70 0 | .. | .. | .. | 41 0 | .. |
| †Dundee .. | 1 | .. | .. | ø17 3 | 100 0a<br>90 0b | .. | 44 0 | .. | 63 0 | .. |
| ‖Edinburgh .. | 1 | .. | .. | .. | 85 0a<br>82 6b | .. | 27 6 | 22 6 | 30 0 | .. |
| *a*Glasgow .. | 1 | .. | .. | .. | 85 0 | 90 0 | 35 0 | .. | 50 0 | 34 9c |

* Ex farm, loose.
† Baled straw, delivered in town.
‖ Bunched or baled straw, delivered.
ø Delivered in town.
*a* Baled and delivered.
*b* Delivered, loose.
*c* Home Moss Litter, in 1½-cwt. bales.

## FEEDING STUFFS: Monthly Average Prices (per ton) at Glasgow and Leith.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | MARCH | | APRIL | | MAY | |
|---|---|---|---|---|---|---|
| | Glasgow | Leith | Glasgow | Leith | Glasgow | Leith |
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Linseed Cake— | | | | | | |
| Home .. .. .. | 8 10 8 | 8 3 9 | 8 4 5 | 8 0 0 | 7 19 0 | 7 19 6 |
| Foreign .. .. .. | 8 7 6 | 7 18 9 | 8 5 0 | 7 15 0 | 8 4 0 | 7 10 8 |
| Undecort. Cotton Cake— | | | | | | |
| Egyptian (Home manufactured) .. .. | 4 17 6 | 4 10 0 | 4 15 0 | 4 11 3 | 4 14 0 | 4 14 6 |
| Palmnut Kernel Cake .. | 7 17 6 | .. | 7 17 6 | .. | 7 17 0 | .. |
| Soya Bean Cake .. .. | 8 0 0 | .. | 8 0 0 | .. | 8 0 0 | .. |
| Coconut Cake .. .. | 7 12 6 | .. | 7 15 0 | .. | 7 10 0 | .. |
| Groundnut Cake, undecort.— | | | | | | |
| (50 % Oil and Album.) .. | 7 2 6 | 7 1 11 | 7 0 0 | 7 2 6 | .. | 7 4 0 |
| (54 % „ „ ) .. | 7 3 2 | .. | 7 1 3 | .. | 6 17 0 | .. |
| Maize Germ Cake, Home mfd. | 7 10 8 | .. | 7 5 11 | .. | 6 18 6 | .. |
| „ „ Meal .. .. | 6 0 8 | .. | 5 18 9 | .. | 5 16 6 | .. |
| Rice Meal .. .. .. | 5 2 2 | .. | 4 19 5 | 5 7 6 | 4 19 6 | .. |
| Bean Meal .. .. .. | 8 16 3 | 8 10 0 | 8 17 6 | 8 6 3 | 8 18 9 | 8 10 0 |
| Barley Meal .. .. .. | 7 15 11 | 7 15 0 | 7 6 3 | 7 10 0 | 7 6 0 | 7 10 0 |
| Fish Meal .. .. .. | 14 12 6 | 15 0 0 | 14 6 3 | 14 2 6 | 14 2 6 | 13 16 0 |
| Maize Meal— | | | | | | |
| Home manufactured .. | 6 3 2 | 6 1 3 | 6 3 11 | 6 0 8 | 6 6 9 | 6 5 0 |
| South African, Yellow .. | 5 10 4 | 5 8 9 | 5 12 2 | 5 8 9 | 5 13 3 | 5 9 6 |
| „ „ White .. | 5 9 5 | .. | 5 9 8 | .. | 5 10 0 | .. |
| Locust Bean Meal .. .. | 8 10 0 | 7 10 0 | 8 10 0 | 7 10 0 | 8 7 6 | 7 10 0 |
| Maize Gluten Feed (Paisley) | 6 6 3 | .. | 6 6 3 | .. | 5 17 6 | .. |
| Maize— | | | | | | |
| Plate .. .. .. | 5 6 11 | 5 1 11 | 5 9 3 | 5 5 8 | 5 10 6 | 5 5 6 |
| African .. .. | 6 5 0 | .. | 6 1 11 | .. | 5 18 6 | .. |
| Oats— | | | | | | |
| Home .. .. .. | 6 10 8 | 7 0 0 | 7 2 2 | 7 6 11 | 7 12 9 | 7 13 6 |
| Barley— | | | | | | |
| Home .. .. .. | .. | 6 10 0 | 6 13 9 | 6 10 0 | 6 10 0 | 6 10 0 |
| Imported .. .. .. | 6 15 0 | 6 8 9 | 6 7 6 | 6 2 6 | 6 6 0 | 5 16 3 |
| Wheat— | | | | | | |
| Home .. .. .. | 5 6 11 | 5 0 0 | 5 9 1 | 5 7 6 | 5 14 9 | 5 13 6 |
| „ (Poultry) .. .. | 5 0 8 | .. | 5 5 4 | .. | 5 12 6 | .. |
| Imported .. .. .. | .. | .. | .. | .. | .. | 5 6 8 |
| Middlings (Fine Thirds or Parings) .. .. .. | 6 7 6 | 6 7 6 | 5 19 8 | 6 3 9 | 6 10 6 | 6 2 6 |
| Sharps (Common Thirds) | 5 19 5 | 6 7 6 | 5 10 4 | 6 1 3 | 5 17 3 | 5 18 6 |
| Bran (Medium) .. .. | 6 5 8 | 6 7 6 | 5 19 5 | 5 18 2 | 5 13 0 | 5 16 0 |
| „ (Broad) .. .. | 6 17 6 | 6 17 6 | 6 11 11 | 6 11 11 | 6 7 6 | 6 9 0 |
| Malt Culms .. .. .. | 5 6 3 | 5 5 0 | 5 16 3 | 5 5 0 | 5 17 3 | 5 4 0 |
| Distillers' Mixed Grains (Dried) | .. | .. | .. | 6 12 6 | 7 0 0 | 6 10 0 |
| Distillers' Malt Grains (Dried) | 6 19 5 | .. | 6 19 2 | .. | 6 10 0 | .. |
| Brewers' Grains (Dried) .. | 6 13 4 | 5 12 6 | 6 13 9 | 5 12 6 | .. | 5 12 0 |
| Crushed Linseed .. .. | 16 0 0 | .. | 16 0 0 | .. | 15 14 0 | .. |
| Locust Beans (Kibbled and Stoned) .. .. .. | 7 13 2 | 7 10 0 | 7 11 11 | 7 10 0 | 7 11 3 | 7 10 0 |
| Beans— | | | | | | |
| China .. .. .. | 7 17 6 | 7 15 0 | 7 17 2 | 7 15 0 | 7 18 9 | 7 18 9 |
| English .. .. .. | .. | .. | .. | .. | .. | 7 12 6 |
| Rangoon (White) .. .. | .. | .. | .. | 6 15 0 | .. | 6 15 0 |
| „ (Red) .. .. | .. | .. | .. | 6 10 0 | .. | 6 10 0 |
| Pease— | | | | | | |
| Calcutta (White) .. .. | 9 6 8 | .. | 9 8 9 | .. | .. | .. |
| Karachi ( „ ) .. .. | 9 0 0 | .. | 9 3 9 | .. | 9 10 0 | .. |
| Feeding Treacle .. .. | 5 5 0 | 5 10 0 | 5 5 0 | 5 10 0 | 5 5 0 | 5 10 0 |
| Sugar-Beet Pulp (English) .. | 6 0 11 | 6 1 8 | 6 2 2 | 6 0 0 | 6 2 0 | 6 2 6 |
| „ „ „ (Irish) .. | 6 0 4 | .. | 6 0 11 | .. | 6 0 6 | .. |
| Linseed Oil, per gall. .. | 0 4 0 | .. | 0 4 0 | .. | 0 4 0 | .. |

## FERTILISERS: Monthly Average Prices (per ton) at Glasgow and Leith.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | Guaranteed Analysis | MARCH | | APRIL | | MAY | |
|---|---|---|---|---|---|---|---|
| | | Glasgow | Leith | Glasgow | Leith | Glasgow | Leith |
| | % | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Nitrate of Soda * | N. 15·5 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 |
| Sulphate of Ammonia (Neutral and Granular) * .. | N. 20·6 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 |
| Calcium Cyanamide † | N. 20·6 | 7 3 9 | 7 2 6 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 |
| Nitrate of Lime | N. 15·5 | .. | 7 10 0 | .. | 7 10 0 | .. | 7 10 0 |
| Nitrochalk * .. | N. 15·5 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 |
| Superphosphate .. | P.A. 13·7 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 |
| " .. | " 16·0 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 |
| " .. | " 18·3 | 3 2 6 | 3 2 6 | 3 2 6 | 3 2 6 | 3 2 6 | 3 2 6 |
| Ground Mineral Phosphate ** .. | P.A. 27·5 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 |
| " " " ** .. | " 34 | 3 10 0 | 3 10 0 | 3 10 0 | 3 10 0 | 3 10 0 | 3 10 0 |
| Potassic Mineral Phosphate | P.A. 18<br>Pot. 10 | 3 10 0 | .. | 3 10 0 | .. | 3 10 0 | .. |
| " " " | P.A. 18<br>Pot. 9 | .. | 3 5 0 | .. | 3 5 0 | .. | 3 5 0 |
| " " " | P.A. 20<br>Pot. 7.5 | 3 5 0 | .. | 3 5 0 | .. | 3 5 0 | .. |
| Kainit (in bags) .. | Pot. 14 | 3 0 0 | 2 17 6 | 3 0 0 | 2 17 6 | 3 0 0 | 2 17 6 |
| Potash Salts .. | Pot. 20 | 3 15 0 | 3 10 0 | 3 15 0 | 3 10 0 | 3 15 0 | 3 10 0 |
| " " .. | " 30 | 4 10 0 | 4 2 6 | 4 10 0 | 4 2 6 | 4 10 0 | 4 2 6 |
| Muriate of Potash (on basis of 80 per cent. purity) | Pot. 50 | 6 17 6 | 6 10 0 | 6 17 6 | 6 10 0 | 6 17 6 | 6 10 0 |
| Sulphate of Potash (on basis of 90 per cent. purity) | Pot. 48·6 | 7 17 6 | 7 10 0 | 7 17 6 | 7 10 0 | 7 17 6 | 7 10 0 |
| Steamed Bone Flour | N. 0·8<br>P.A. 28 | 6 5 0 | .. | 6 5 0 | .. | 6 5 0 | .. |
| " " " | N. 0.8<br>P.A. 30 | .. | 5 15 0 | .. | 5 15 0 | .. | 5 15 0 |
| Bone Meal (Indian) | N. 4<br>P.A. 20 | 6 15 0 | 6 10 0 | 6 15 0 | 6 10 0 | 6 15 0 | 6 10 0 |
| Basic Slag ‡ .. | P.A. 12 | 2 5 0 | .. | 2 5 0 | .. | 2 5 0 | .. |
| " " .. | " 13 | 2 7 0 | 1 5 6 | 2 7 0 | 1 5 6 | 2 7 0 | 1 5 6 |
| " " .. | " 14 | 2 9 0 | 1 7 6 | 2 9 0 | 1 7 6 | 2 9 0 | 1 7 6 |
| " " .. | " 15 | .. | 1 10 0 | .. | 1 10 0 | .. | 1 10 0 |
| " " (Imported)‖ | " 15 | .. | 2 10 0 | .. | 2 10 0 | .. | 2 10 0 |

Abbreviations:—N. = Nitrogen; P.A. = Phosphoric Acid; Pot. = Potash.

* Carriage paid, in 6-ton lots. † Carriage paid, in 4-ton lots.

** Fine grist, 90 per cent fineness through prescribed sieve.

‡ Basic Slag:—At Glasgow—80 per cent citric soluble and 80 per cent fineness; F.o.r., in 6-ton lots.
At Leith—80 per cent citric soluble and 80 per cent fineness. On rail at Middlesboro'; carriage paid to Border stations 13s. to 15s. extra, and to Lothian stations 16s. to 17s. extra.

‖ Ex-store: 2s. 6d. per ton less ex-ship, Leith.

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# ESTATE MANAGEMENT AS AFFECTED BY RECENT AGRICULTURAL DEPRESSION

THE effect of the agricultural depression of recent years upon estate management and policy is well understood by those in immediate contact with the problems involved, but is perhaps insufficiently appreciated by agriculturists as a whole or by the general public.

The fall in prices and lack of demand for certain agricultural products did not simultaneously affect all branches of the industry. The arable farms of the East were the first to suffer. The dairying districts of the West and South-west next experienced the troubles arising from over-production. Lastly, the sheep-breeding and cattle-raising areas met the same difficulties. The reaction upon estate management varied, therefore, in different parts of Scotland as regards both date and intensity.

The first and obvious result was a fall in rental which became general throughout Scotland. Not only did rents fall on the re-letting of farms, but reductions to existing tenants became necessary in many cases. The fall in rental as disclosed by an examination of the County Valuation Rolls would have been much greater had it not been for one or two compensating factors.

When the agricultural depression was most acute about 1932-33, a percentage remission of rents was very generally made over one or two years. The percentage varied widely, but 10 to 20 per cent was a broad figure. These temporary remissions did not appear in the Valuation Roll.

The payments by owners to occupiers of lands under Section 47 of the Local Government (Scotland) Act 1929—commonly known as the derating payments—came at a very opportune time, and were undoubtedly of great assistance to those whom the payments were intended to benefit. These payments were fixed at a sum equal to two and a half times the owner's rates in the standard year (1930-31). The amount relative to rent varied therefore according to the incidence of the owner's rates in any particular county or parish. Speaking generally, the sum received by the occupier varied from 4 to 8 per cent of the rent, and the average has probably been about 5½ per cent. The occupier also benefited in so far as his own rates were substantially reduced, being paid on an assessable value of one-eighth of the rent.

Keeping these considerations in view, the following figures, taken from the Valuation Rolls of half a dozen typical agricultural parishes in central and southern Scotland, are of some interest. Highland parishes are purposely omitted, as the circumstances—especially in crofting parishes—are altogether different.

| Parish | Agricultural Rental 1929-30 | Agricultural Rental 1934-35 | Fall per cent |
|---|---|---|---|
| A . . . | £11,350 | £10,286 | 9·4 |
| B . . . | 10,218 | 8,620 | 15·6 |
| C . . . | 9,600 | 8,027 | 16·4 |
| D . . . | 8,067 | 7,343 | 9·0 |
| E . . . | 10,495 | 9,998 | 4·8 |
| F . . . | 7,085 | 6,807 | 4·0 |

The fall appears to be most pronounced in those parishes where the farms are large, and less marked in the parishes where smaller holdings predominate. If an investigation were made over a longer period, it would no doubt be found that there had been a greater rise in rent immediately after the war in the case of the larger farms, and that the rents of the smaller holdings had remained more stable.

In considering the effect of falling rental upon management, it is as well to review estate expenditure in one or more typical instances. The figures given below are taken from two agricultural estates where the standard of equipment and maintenance is good, but where there has been no extravagant or uneconomic expenditure. There has, however, been considerable outlay under the Housing (Rural Workers) Acts, in accordance with a settled policy for the improvement of all the farm cottages on the estates. This outlay is likely to continue for a year or two longer until every house has been dealt with.

### ESTATE I

| | 1929-30 | 1933-34 | Five Years' Average | Per cent of Average |
|---|---|---|---|---|
| *Receipts*— | | | | |
| 1. Rental (including mansion-house, grass parks and shootings) . . . | £5,898 | £5,208 | £5,658 | 79·0 |
| 2. Woods . . . . | 1,714 | 1,660 | 1,357 | 19·0 |
| 3. Lands in hand . . | 15 | 329 | 98 | 1·4 |
| 4. Game and rabbits sold and miscellaneous . | 9 | 50 | 40 | ·6 |
| | £7,636 | £7,247 | £7,153 | 100·0 |

| | 1929-30 | 1933-34 | Five Years' Average | Per cent of Average |
|---|---|---|---|---|
| *Expenditure—* | | | | |
| 1. Public Burdens, net | £1,315 | £1,377 | £1,469 | 22·7 |
| 2. Allowances to tenants | 20 | 218 | 167 | 2·6 |
| 3. Fire Insurance | 89 | 103 | 101 | 1·6 |
| 4. Repairs and renewals | 1,078 | 1,848 | 1,764 | 27·6 |
| 5. Woods | 1,735 | 1,522 | 1,529 | 24·1 |
| 6. Game | 406 | 320 | 394 | 6·2 |
| 7. Mansion-house | 337 | 308 | 322 | 5·1 |
| 8. Lands in hand | 251 | 261 | 298 | 4·6 |
| 9. Pensions and subscriptions | 115 | 111 | 116 | 1·8 |
| 10. Management, legal expenses and miscellaneous | 156 | 263 | 238 | 3·7 |
| | £5,502 | £6,331 | £6,398 | 100·0 |
| Surplus | £2,134 | £916 | £755 | |

ESTATE II

| | | | | |
|---|---|---|---|---|
| *Receipts—* | | | | |
| 1. Rental (including shootings) | £11,782 | £11,256 | £11,712 | 94·2 |
| 2. Woods | 589 | 759 | 605 | 4·9 |
| 3. Game and rabbits sold | 48 | 20 | 24 | ·2 |
| 4. Miscellaneous receipts | 77 | 83 | 82 | ·7 |
| | £12,496 | £12,118 | £12,423 | 100·0 |
| *Expenditure—* | | | | |
| 1. Public Burdens, net | £3,190 | £2,916 | £3,187 | 34·1 |
| 2. Allowances to tenants | 117 | 826 | 543 | 5·8 |
| 3. Fire Insurance | 161 | 146 | 155 | 1·6 |
| 4. Repairs and renewals | 2,237 | 3,417 | 3,200 | 34·3 |
| 5. Woods | 946 | 1,242 | 1,112 | 11·6 |
| 6. Game | 816 | 781 | 814 | 8·7 |
| 7. Pensions and subscriptions | 53 | 47 | 51 | ·5 |
| 8. Management and legal expenses, etc. | 292 | 425 | 313 | 3·4 |
| | £7,812 | £9,800 | £9,375 | 100·0 |
| Surplus | £4,684 | £2,318 | £3,048 | |

Some explanation regarding these records is necessary. Estate I is taken as typical of a large number, and the figures are a fair average.

It will be observed that rental has fallen in the five years by £690, and that in addition allowances to tenants consisting of special or temporary abatements increased from £20 to £218, so that the actual fall on a rental of £5,898 was £888, equal to just over 15 per cent.

The owner's public burdens showed a slight increase of £62 as between the two dates. The five years' average is much higher than either figure, on account of the rise in Income Tax during the intervening years. No surtax is included, and any repayments of Income Tax for maintenance are deducted. The burdens for the five-year period represent nearly one-fourth of the total expenditure and 5s. 3d. per £ on the average rental. This is less than the amount payable on many estates.

Repairs and renewals show an increase on the five-year period of £770, due almost entirely to expenditure under the Housing (Rural Workers) Act schemes. This expenditure is net after deducting any grants received, and represents more than one-fourth of the average total expenditure.

It will be observed that over the five years the expenditure on woods exceeded receipts by £172. This was accounted for by a fairly high proportion of young woods, so that the normal sales of mature timber are not large.

It should be explained that the heading "Mansion-house" is made up almost entirely of rent and occupier's rates. The rent is credited in "Rental."

It would appear that there was a considerable loss on "Lands in hand." This is not actually so, for the reason that expenditure includes wages paid for taking charge of grass parks, the revenue from which is included in "Rental."

From the causes named the surplus income has fallen from £2,134 to £916, and the average surplus over the five years is even less—£755, owing mainly to higher taxation in the intervening years.

Estate II is an example of a purely agricultural unit, with a comparatively small area of woodlands and a moderate shooting rental. The whole subjects are let. The fall in rental in the five-year period is £526 and the allowances to tenants show an increase of £709, a combined fall of £1,235 or 10·5 per cent.

The owner's public burdens in this case show a slight decrease, but nevertheless represent more than one-third of the total expenditure and are equal to 5s. 5d. per £ of average rental. Repairs and renewals show a rise of £1,180, due to schemes under the Housing (Rural Workers) Acts. There is a considerable deficiency on "Woods," due to no substantial sales of timber having been made during the period.

The "Game" expenditure appears large, but is recouped by shooting rents, which could not otherwise be obtained.

The surplus income fell to almost exactly one-half in the five-year period.

These returns have been given in some detail, for the purpose of illustrating the problems with which agricultural estates are at present faced.

All personal expenditure is carefully excluded, such as maintenance of gardens. Surtax is omitted, and there is no mortgage interest or instalments of Death Duties. It is obvious, therefore, that if outgoings of this nature were included there would be no margin at all.

The problem is therefore one of no little difficulty. How can it best be faced ?

It must be recognised that the fall in rental may not yet have terminated. The " Allowances to tenants " item will probably tend to decrease or perhaps to disappear as leases expire and come to be renewed, but this will merely represent a decrease under expenditure which will be counterbalanced by a decrease in rental. No decrease under public burdens is probable. County rates are not decreasing, and on the contrary show a tendency to rise in most counties. Stipends are now mostly standardised in money. A further reduction in Income Tax would at once be reflected in a decrease under this head of estate expenditure. Such a reduction can scarcely be looked for under existing national conditions. There remain " Woods " and " Repairs and Renewals."

With regard to woods, much depends upon the circumstances of the individual estate. There may be no reserve of mature timber from which regular annual fellings can be made, or the timber may be of a description not easily marketed in comparatively small quantities. There are, however, many estates where such a reserve does exist, and where for various reasons no sustained cuttings have been made, while the forestry staff has nevertheless been maintained. In that event a survey of the whole position may result in the adoption of a felling policy which can materially improve the financial returns, without undue depletion of the growing stock. In spite of all that has been written or said to the contrary, there is no reason why private woods, carefully and consistently managed, should not furnish a sustained yield and a moderate surplus over a period of years. This branch of estate management has in recent years been receiving more attention than formerly, more particularly on the side of marketing, and with a considerable measure of success.

Repairs and renewals present the most difficult questions in the face of a decreasing estate revenue. There is a natural tendency to reduce maintenance costs to keep pace with a falling rental. In many instances this is a matter of necessity, and not of choice. There are certain ways in which savings can be made without loss of efficiency. There has, perhaps in the past, been too much hesitation in trying new materials or new methods of construction, due to the belief that the methods and materials which have been already tried and tested must still be the best to-day. This may be incorrect. Many new systems of construction have been evolved in the last fifteen years, and while some are likely to be discarded after experience, nearly all are worthy of trial and experiment. Examples are to be found in the use of concrete blocks in various forms for walls, plaster boards in place of ordinary lath and plaster, and roofing materials in tiles, sheets, or wood shingles in place of slates. Concrete, or compositions of similar nature, are now in use for water pipes, and have considerable merit in cases where waters have any action on metals. Most of these new products are cheaper, although not always more convenient in use, or in replacement. It must be admitted, however, that here and there a new material is found which is of value. It is a function of management to watch for such developments and to reduce costs where this can be done without loss of efficiency. It is probable that in many cases timber grown on an estate could be utilised to better advantage in maintenance and in new work. Home-grown timber often gets a bad name through no intrinsic fault, but through inadequate seasoning, inaccurate sawing and indifferent selection.

There are several wider questions of policy which demand the consideration of the landowner at the present time and these may be briefly referred to. It is natural to ask in a period of decreasing revenue—Has the fall yet reached an end, or is the decrease to continue ? If a further shrinkage is anticipated, what policy should the owner pursue, in face of fixed charges which must be met, and maintenance charges which are not decreasing ? This anxious problem confronts many owners to-day and it is scarcely possible to give any concise reply. There are certain general considerations relating to Scottish agriculture which deserve examination before attempting an answer.

There are difficulties which the agricultural occupier has to meet to-day, and which although not new appear to be more prominent than formerly. In most parts of Scotland it must be admitted that the average standard of cultivation does not seem to be as high as it was. In spite of fairly favourable seasons for dealing with weeds, arable land is not so clean as formerly. There are many notable exceptions, but these do not affect the general average. Thistles, runches, couch grass and other weeds of arable land are only too much in evidence. Every allowance may be made for financial difficulties having brought about a reduction in labour employed, but this is not the whole explanation. The same increase of weeds is evident on much permanent pasture land—more particularly thistles, ragwort and knapweed. On hill land the increase of bracken has been the subject of discussion by leading agricultural societies and in correspondence in the agricultural press.

The financial stringency in agriculture has also affected the application of lime and manures in adequate quantities. A reduction in the use of artificial fertilisers may matter less so long as there are reasonably adequate applications of dung and the arable land is kept clean and thoroughly cultivated. In many cases, however, such conditions do not exist, and consequent deterioration and loss of fertility must follow.

The problem of lime is one of some magnitude. The testing of typical soils, now more widely undertaken, shows in only too many cases and over large areas that there is a considerable and increasing lime deficiency.

Turning to stock farming, while definite progress has been made in combating losses from certain diseases such as tuberculosis in cattle, or braxy in sheep, there are still other diseases causing heavy losses, such as grass sickness in horses and contagious abortion in cattle. These diseases are not decreasing.

During the last few years there has been observable in many sheep-farming districts a distinct falling-off in the number of lambs born and a further more serious loss among lambs of four to eight weeks old. The causes are being studied but are meanwhile obscure.

All these difficulties have a bearing upon estate management and policy. Sooner or later they must react upon and adversely affect the letting of farms and constitute an obstacle to returning prosperity in agriculture.

There has, perhaps, been a tendency on many estates to treat such problems as being purely within the sphere of the farmer, the agricultural colleges, or the research stations. The resultant effects may be partly realised and deplored, but without any determined or sustained endeavour to take a hand in finding a cure.

The Highland and Agricultural Society of Scotland is representative of all interests connected with agriculture, and is, therefore, in a position to do much to guide and support every movement for the good of the industry as a whole.

The Department of Agriculture for Scotland has a similar responsibility, although in a somewhat different sphere. The Department is perhaps now the largest landowner in Scotland, and is therefore directly concerned with estate management and policy just as much as private landowners.

It has often been a matter of difficulty in the past, when dealing with the problems of management, to ascertain exact figures with regard to any particular holding. It has fortunately become much more common in recent years to keep records and accounts showing the results of farming operations. This has come about mainly for the purpose of Income Tax adjustments, but it is of considerable service in dealing with questions of rent, and even more in revealing the weaknesses or losses in certain branches of the business. However intimately a farmer may know his own farm and its receipts and expenses, he cannot under present-day conditions make the most of his business without proper records and accounts. Mention should here be made of the scheme conducted by the Department of Agriculture for Scotland, in conjunction with the Colleges of Agriculture, for the collection and analysis of farm accounts kept on a uniform system.

A reduction of rent is not always the best method of meeting the needs of a farm which is yielding unsatisfactory results. It may be more in the interest of the occupier to assist him in searching out the root causes of decreasing yields or returns, and endeavouring to find the remedy which will maintain or increase production.

There are many points of contact between owner and occupier on any well managed estate. The conditions regarding maintenance vary widely in different districts, and in the terms of estate leases. In most instances the obligation for maintenance of buildings, fences, drains, etc., lies wholly on the occupier. There is much to be said, as a matter of estate policy, for maintenance at the joint expense of owner and occupier. The joint interest and responsibility should make for both efficiency and economy, and would very often avoid disputes or arbitrations at a waygoing as to alleged failure to implement contracts. Co-operation and mutual sharing of cost might well be extended further to the cutting of bracken, tile draining and in other ways. Such outlays by the owner, although not always easy to make, should, taking a long view, tend to maintain the value and efficiency of the estate, and avoid the periodic expenditure of large sums at renewal of leases or changes in tenancy which are otherwise apt to occur, and may be the cause of serious financial embarrassment.

The figures given and conclusions reached in this article may be summarised in the following terms :

(1) The effect of agricultural depression upon estate management has varied in degree and in date, but has been generally felt throughout Scotland.

(2) At the most acute period the situation was partly met by general percentage abatement of rents, or by more permanent reductions. The payments by owners to occupiers under the Local Government (Scotland) Act also contributed to meet the occupier's difficulties.

(3) The fall in Valuation Roll rental of agricultural subjects, while not showing the full amount of rent reduction, has varied from 4 to 16·4 per cent in certain typical parishes in the five-year period.

(4) The actual fall in total rental in the case of two typical estates amounted to 15 per cent and 10·5 per cent respectively in the five-year period.

(5) The expenditure on the same two estates shows little change in the amount of public burdens, which amount to one-fourth and one-third of the total outgoings. The cost of repairs and renewals is roughly the same, but tends to increase owing to expenditure under the Housing (Rural Workers) Acts schemes.

(6) The fall in net revenue amounts to between 50 and 60 per cent.

(7) The fall in rental may not yet have ceased, and may go farther. It is difficult to curtail repairs and renewals—at any rate for a few years to come—if the improvement of cottages is to be completed.

(8) The woods on some estates are capable of greater development and might provide more material for estate work, as well as some increased revenue.

(9) There are possibilities in new building materials and new designs, for economies in construction and repair of farm steadings, etc.

(10) The cultivation and management of arable land does not seem on the average to be as good as formerly. This is specially noticeable in weed growth. Permanent pasture shows the same increase in pasture weeds. The spread of bracken on hill ground is generally recognised and deplored.

(11) Certain diseases of live stock have not yet been effectively dealt with. A decreased percentage of lambs is very noticeable in many districts.

(12) The practice of keeping accounts and records has become more general, and is of advantage both to occupiers and to owners.

(13) It is desirable that those responsible for the management of an agricultural estate should be in the closest possible touch with the occupiers of the holdings—large or small. No two holdings are alike, and a good understanding of mutual difficulties is the best means of overcoming them.

(14) It seems desirable for efficient maintenance of the farm equipment of buildings, fences, etc., that costs should be shared as far as possible. Such a policy is likely to be helpful to both parties, to keep expenditure at a reasonably level figure, and to secure economy.

# RECENT PIG-FEEDING EXPERIMENTS[1]

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In the production of a bacon pig the food costs amount to approximately 75 per cent of the total cost of production. What and how to feed are therefore very important factors in economical pig production, and it has been with these factors in mind that experiments have been conducted by the Scottish Advisory Committee on Pork and Bacon Production during the past four years at the three Scottish Agricultural Colleges and the Duthie Experimental Stock Farm.

The main object of these experiments has been to find a number of rations that may be recommended to farmers according to the variation in price of the different foods commonly used in pig-feeding.

The number of pigs so far used in these experiments is 514, and fourteen different rations have been tested against a fixed standard. The proportion of protein to carbohydrate foods has been altered in all the rations, in accordance with the usually accepted standards, with the increasing age of the pigs. The composition of the basal standard ration is as follows, all parts being by weight :—

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[1] Paper read at a Conference of County Organisers held at Auchincruive, 23rd to 25th July 1935.

| | 1st Period Parts | 2nd Period Parts | 3rd Period Parts |
|---|---|---|---|
| Sharps . . . | 4 | 3 | 3 |
| Ground Barley . . | 3 | 3 | 3½ |
| Ground Maize . . | 2 | 3 | 3 |
| White Fish Meal . . | 1 | 1 | ½ |

The first and second periods are each of six weeks' duration, and the third is from the end of the second period until the pigs have reached bacon weight.

The experiments have fallen into two main groups designed (1) to find economical substitutes for fish meal, and (2) to ascertain whether other cereal foods can be satisfactorily substituted for those used in the basal diet.

Among the protein foods used have been extracted soya-bean meal, dried separated milk, extracted earthnut meal, blood meal and meat and bone meal, and among the carbohydrate foods tests have been made with crushed oats, potatoes, barley and whey paste. Some of these rations have been tested at all the centres whereas others have been experimented upon at only one or two centres.

The simplest method of approach to the results will be to take each ration separately and, where tests have been made at more than one centre, to give indications of the similarity or difference of the results obtained.

**Extracted Soya-bean Meal.**—This food has been tested at all three colleges with varying degrees of success. The first experiment in this series carried out on this food was conducted at the West of Scotland College and the ration consisted of :—

| | 1st Period Parts | 2nd Period Parts | 3rd Period Parts |
|---|---|---|---|
| Sharps . . . . | 5 | 5 | 5 |
| Ground Barley . . | 3 | 3 | 3 |
| Extracted Soya-bean Meal | 1 | 1 | 1 |

It will be noted that this ration was not supplemented with either minerals or vitamins.

After forty-two days a number of the pigs on the experimental ration were showing distinct symptoms of leg weakness in addition to a slower live-weight increase than pigs fed on the standard ration: the former having an average daily increase of 0·77 lb. and the latter one of 1·20 lb. During the subsequent feeding period the experimental ration was altered and the pigs were divided into two groups. Half of them were put on to a ration containing dried beet pulp in which the soya-bean meal was retained at the original level; the other half were put on to a ration containing

½ part soya-bean meal and ½ part white fish meal. It would appear that these treatments counteracted the rachitic tendency, but the rate of growth still remained below that of the control group. The ration containing fish meal and soya bean proved superior to the one containing dried beet pulp and soya bean. The average daily live-weight increases for the three rations—control, dried beet pulp and soya bean, and fish meal and soya bean—during this second period were 1·66, 1·13 and 1·21 lb. respectively, despite the consumption of equal quantities of food in each group.

In a subsequent experiment at the same centre the extracted soya-bean ration was supplemented with both minerals and vitamins, and the following ration has been tested at all the centres :—

| | 1st Period Parts | 2nd Period Parts | 3rd Period Parts |
|---|---|---|---|
| Sharps . . . . . | 4½ | 3 | 3 |
| Ground Barley . . . | 3 | 3 | 3½ |
| Ground Maize . . . | 2 | 3 | 3 |
| Extracted Soya-bean Meal . | 1½ | 1 | ½ |

plus 3 per cent of a mixture of 5 parts ground limestone and 1 part salt; plus 5 cubic centimetres of cod-liver oil per pig per day until the average live weight of the pigs reached 100 lb.

The addition of minerals and cod-liver oil to this ration caused a marked difference to be obtained at the West of Scotland College when compared with the results obtained in the previous trial. Two experiments were conducted at this centre with the following results :—

| | | Average Daily Live-weight Increase lb. | Food per lb. Live-weight Increase lb. |
|---|---|---|---|
| 1st Trial (109 days) | Control Group . . . | 1·24 | 3·59 |
| | Experimental Group . . | 1·17 | 3·89 |
| 2nd Trial (137 days) | Control Group . . . | 1·29 | 2·69 |
| | Experimental Group . . | 1·18 | 2·94 |

The results obtained at the East of Scotland College favoured the soya-bean meal ration to a greater extent than those shown above. At this centre three small-scale trials were carried out with the following results :—

| | No. of Pigs | Average Daily Live-weight Increase lb. | Food per lb. Live-weight Increase lb. |
|---|---|---|---|
| 1st Trial—Control . . . | 5 | 1·16 | 3·66 |
| Experimental . . | 6 | 1·11 | 3·84 |
| 2nd Trial—Control . . . | 4 | 1·23 | 2·60 |
| Experimental . . | 4 | 1·22 | 2·63 |
| 3rd Trial—Control . . . | 4 | 1·29 | 2·32 |
| Experimental . . | 4 | 1·27 | 2·36 |

The health of the pigs in the first trial was normal. In the second trial, however, the pigs in the experimental group developed leg weakness after the cod-liver oil had been stopped for about one month. The cod-liver oil was then reintroduced into the food and although the pigs did not recover, the degree of stiffness was less severe at the end of the trial. In the third trial the cod-liver oil was continued until the average live weight of the experimental pigs reached 130 lb. and no signs of leg weakness were reported.

At the North of Scotland College the results obtained with soya-bean meal were extremely disappointing ; after forty-two days the experiment was stopped and the pigs were fed on the control diet. During the period of the trial the experimental pigs showed an average daily live-weight increase of 0·60 lb. and a food consumption of 5·83 lb. per lb. live-weight increase, as compared with the figures of 0·96 and 3·61 lb. for the control group.

Not only was the ration proving uneconomic but the pigs were decidedly ill-thriving, showing the normal symptoms of dirty, harsh coats and emaciated condition. No definite reason can be given for the unsatisfactory nature of the results obtained at this centre on this ration. The soya-bean meal was tested by Professor Hendrick who found the sample perfectly good. The pigs subsequently recovered when they were put on to the control diet containing fish meal.

**Extracted Earthnut (Groundnut) Meal.**—This food has been tested at four centres and very similar results were obtained at each. The ration was :—

| | 1st Period Parts | 2nd Period Parts | 3rd Period Parts |
|---|---|---|---|
| Sharps . . . . . . | 4 | 3 | 3 |
| Ground Barley . . . | 2½ | 3 | 3½ |
| Ground Maize . . . | 2 | 3 | 3 |
| Extracted Groundnut Meal . | 1½ | 1⅓ | ⅔ |

plus a mineral mixture of 4 parts steamed bone flour and 1 part salt—2½lb. per cwt.

In view of the close similarity of the results obtained at each centre, the figures for live-weight increase and food consumption may be summarised :

| | | Average Daily Live-weight Increase lb. | Food per lb. Live-weight Increase lb. |
|---|---|---|---|
| Summary of 4 Experiments | Control . . . . | 1·18 | 3·21 |
| | Experimental . . . | 1·10 | 3·48 |

This result of slower growth and higher food-consumption does not appear to favour the groundnut meal, but the lower purchase cost of the experimental diet resulted in a close similarity in food cost for the two groups.

It must be borne in mind that in these experiments it was the extracted meal and not the cake meal that was used, and this may explain the more satisfactory nature of the results obtained when compared with earlier reported trials. Cake meal contains too much oil for economical feeding and, in addition, is unsuitable for the production of bacon of the best quality.

**Dried Separated Milk.**—This food has been tested at only one centre and its value is of especial importance in view of the Scottish Milk Board's recent activities in producing a comparatively low-priced product. Three experiments have been conducted at different times.

In the first the ration consisted of :—

| | 1st and 2nd Periods Parts | 3rd Period Parts |
|---|---|---|
| Sharps | 4 | 3 |
| Ground Barley | 3 | 6 |
| Dried Separated Milk | 1 | 1 |

After forty-two days' feeding a number of the pigs were reported to be suffering from leg weakness, and the experimental group was divided into two sections. One of these sub-groups was continued on the experimental diet and the other, which contained the poorer pigs from the original experimental group, was put on to a ration in which the protein foods consisted of ½ part white fish meal and ½ part dried separated milk. No further troubles were reported, nor did any of the pigs remaining on the original diet develop leg weakness during the subsequent feeding period.

The comparable figures for live-weight increase of the control and experimental groups and sub-groups were :—

| | Average Daily Live-weight Increase | |
|---|---|---|
| | 1st 42 Days lb. | Subsequent Period lb. |
| Control | 1·20 | 1·66 |
| Cereals and dried separated milk | 0·98 | 1·24 |
| Cereals and dried separated milk and fish meal | .. | 1·17 |

All the groups received the same quantity of food, and it will be noted that the addition of fish meal to the dried separated milk ration did not effect any economy in the rate of production when compared with the original experimental diet.

In the second and third trials the ration consisted of :—

| | 1st Period Parts | 2nd Period Parts | 3rd Period Parts |
|---|---|---|---|
| Sharps | 4 | 3 | 3 |
| Ground Barley | 3 | 3 | 3½ |
| Ground Maize | 2 | 3 | 3 |
| Dried Separated Milk | 1 | 1 | ½ |

plus minerals as for the soya-bean meal ration, *i.e.* the dried separated milk replaced the white fish meal in the control ration part for part by weight.

The pigs grew well, but the results were not in favour of the dried separated milk as the following figures show :—

| | Average Daily Live-weight Increase lb. | Food per lb. Live-weight Increase lb. |
|---|---|---|
| 1st Trial—Control | 1·24 | 3·59 |
| Experimental | 1·17 | 3·89 |
| 2nd Trial—Control | 1·29 | 2·69 |
| Experimental | 1·15 | 3·03 |

These results are, however, somewhat better than those obtained during the first trial, possibly on account of the inclusion of the mineral supplement.

**Meat and Bone Meal.**—This food was tested only at the North of Scotland College, the meat and bone meal replacing white fish meal part for part in the control diet, with the following results :—

| | Average Daily Live-weight Increase lb. | Food per lb. Live-weight Increase lb. |
|---|---|---|
| Control diet | 1·16 | 3·8 |
| Experimental diet | 1·05 | 4·2 |

The meat and bone meal used in this experiment contained 42 per cent albuminoids. It is probable that with a higher grade product a more satisfactory result would have been attained.

**Blood Meal.**—An experiment with blood meal was carried out at the North of Scotland College in which the ration in the first period consisted of :—

| | Parts |
|---|---|
| Sharps | 4 |
| Ground Barley | 3½ |
| Ground Maize | 2 |
| Blood Meal | ½ |

plus minerals as in the soya-bean meal ration.

This, however, proved unsuccessful. After the trial had been in progress for two weeks the pigs receiving the blood meal ration were found to have made very poor gains and were exhibiting the first stages of rickets. Their actual average daily live-weight increase during this period was only 0·47 lb. as compared with an average of 0·70 for the controls. For this period onwards the animals were fed on the control diet with consequent improvement.

The explanation of the failure of the blood meal ration would appear to lie in the process of manufacture of the product used. No details of this are available, but from the appearance of the product it may be deduced that it had been made at an excessively high temperature as it was almost black in colour and very gritty. Such a product has been shown to have very little biological value, and it is not surprising that the pigs fed thereon failed to thrive.

**Whey Paste.**—Whey paste is a semi-solid food containing approximately 40 per cent water. It is very low in protein content and is therefore classed with the carbohydrate foods. One test was made on this food at the West of Scotland College in which 10 per cent of whey paste was mixed with the control ration. The results in food consumption and live-weight increase were practically identical in the control and the experimental groups.

**Oats.**—Oats have been used to replace (1) maize ; (2) sharps and maize ; (3) sharps and ground barley.

The first tests on oats made in this series of experiments were carried out by the West of Scotland College. Two trials were completed, in both of which the oats replaced the whole of the maize in the control diet. In the first trial ordinary crushed oats were used, but in the second the oats were kiln-dried and then finely ground. The whole of the husk was included in both cases.

The production results for both trials were :—

| | Average Daily Live-weight Increase lb. | Food per lb. Live-weight Increase lb. |
|---|---|---|
| Trial 1—Control . . | 1·24 | 3·59 |
| Crushed Oats . | 1·12 | 4·00 |
| Trial 2—Control . . | 1·29 | 2·69 |
| Ground Oats . | 1·17 | 2·98 |

It is impossible to compare the relative merits of crushed and ground oats from two experiments conducted at different times, but the general observation to be drawn would be that there was very little to be gained by kiln drying and grinding as compared with the simple process of crushing.

Subsequent tests were made at all four centres. In one of these, crushed oats replaced ground barley in the control diet during the second feeding period and both barley and sharps in the third.

The final results obtained at each centre, together with a summary of all four experiments, were :—

| | Average Daily Live-weight Increase | | Food per lb. Live-weight Increase | |
|---|---|---|---|---|
| | Control lb. | Experimental lb. | Control lb. | Experimental lb. |
| West . . | 1·24 | 1·16 | 2·86 | 3·14 |
| East . . . | 1·24 | 1·13 | 2·79 | 3·18 |
| North . . | 1·02 | 1·06 | 3·30 | 3·30 |
| Duthie Farm . | 1·13 | 1·09 | 3·99 | 4·25 |
| Average . . | 1·16 | 1·11 | 3·21 | 3·47 |

In the other test crushed oats replaced the ground maize in the control diet during the second feeding period and both the maize and the sharps in the third. The results were as follows :—

| | Average Daily Live-weight Increase | | Food per lb. Live-weight Increase | |
|---|---|---|---|---|
| | Control lb. | Experimental lb. | Control lb. | Experimental lb. |
| West . . . | 1·24 | 1·14 | 2·86 | 3·18 |
| East . . . | 1·24 | 1·11 | 2·79 | 3·25 |
| North . . | 1·20 | 1·18 | 3·40 | 3·40 |
| Duthie Farm . | 1·13 | 1·07 | 3·99 | 4·40 |
| Average . . | 1·20 | 1·12 | 3·21 | 3·60 |

The indications are that crushed oats are not equal in food value for pigs to the cereal foods in the control diet. It is also worthy of note that the differences between the control and experimental diets were not so great in the Northern as they were in the Eastern and Western centres.

**Potatoes and Barley.**—The greater number of the trials conducted at the East of Scotland College have dealt with the utilisation of potatoes. A large number of tests have been made, and the system adopted has been to feed the pigs a fixed daily quantity of a basal diet high in protein throughout the entire feeding period. In order to appease the increasing appetite of the pig, this ration has been supplemented with steamed potatoes in accordance with the pig's appetite, thus automatically widening the protein to carbohydrate ratio with its increasing age.

The basal ration which has proved the more successful has consisted of :—

| | Parts |
|---|---|
| Sharps . . . . . . | 4 |
| Ground Barley . . . . . | 3 |
| White Fish Meal . . . | 2 |
| Extracted Soya-bean Meal . . | 1 |

This ration has been fed at the rate of 2½ lb. per pig per day from the time that the pigs have been capable of consuming this quantity—usually at 11 to 12 weeks of age—and from then onwards the steamed potatoes have been fed in sufficient daily quantity to satisfy the pig's appetite.

The average results of the first three trials were :—

| | Average Daily Live-weight Increase lb. | Meal Equivalent per lb. Live-weight Increase lb. |
|---|---|---|
| Control . . . | 1·22 | 3·36 |
| Experimental . . . | 1·21 | 3·40 |

Meal Equivalent—4 lb. potatoes = 1 lb. meal.

The results of individual trials also show very close agreement and indicate generally the suitability of the method of feeding adopted. It is, however, essential if satisfactory results are to be obtained to wait until the pigs are well grown and capable of consuming the full amount of the basal diet before potatoes are given. If the potatoes are fed too early the animals are apt to become pot-bellied and thriftless.

Other carbohydrate foods may, if desired, be fed in place of potatoes ; very satisfactory results have been obtained in the East of Scotland when ground barley has been the carbohydrate food fed in this manner.

**Carcase quality.**—Since the introduction of the Pigs Marketing Scheme, actual carcase measurements have been taken at the graded portions of the pig. The number of measurements taken are not, however, sufficient for definite conclusions to be given as to the superiority or otherwise of certain rations—so far as grade is concerned. It is, however, worthy of note that grading throughout has been above the basic grade ; possibly this result has been obtained more through the method of feeding adopted than from the actual rations fed.

At an early stage in the experiments it was found that the West and East of Scotland Colleges were obtaining some very excellent food conversion figures. In order to standardise the method of experimentation, this method of feeding has been adopted at all the centres with a subsequent saving in the food bill and a probable improvement in grade. The system of feeding is to ration the pigs according to their age. Newly weaned pigs are fed 1 lb. for every 28 lb. live weight (*i.e.* a pig of 35 lb. receives 1¼ lb. and one of 42 lb. receives 1½ lb. food). This quantity is then increased by ¼ lb. per pig per week until a maximum of 6 lb. is reached, and this quantity is never exceeded at either the East or the West centre. In the North, however, it has been found that the pigs cannot be finished in a satisfactory condition on so restricted a diet, and this quantity has been exceeded on occasions. Nevertheless, the method is a sound one and it is possible that far greater economy may be effected by control of quantity than has hitherto been realised. Preliminary trials at the Duthie Experimental Stock Farm indicate great possibilities in rationed feeding.

**Discussion.**—Of all the rations so far used in these experiments not one can be said to be superior to the control diet for production purposes, nor have any of them proved more economical when the food cost has been ascertained, despite the relative cheapness of some of the products used to replace those in the control ration. Such a result over so many different rations demonstrates very clearly the mistaken policy of coupling cheapness with economy. Many of the rations may, however, be considered suitable when surplus home-grown foods such as potatoes and oats are to be disposed of, and the actual cash value to be attributed to such foods is not of primary importance. Actually the potatoes fed in the experiments outlined were given a value of 30s. per ton, and at this figure the standard ration was the cheaper when production costs were considered. To make the costs about equal a value of 25s. would have to be placed on the potatoes. From the point of view of production crushed oats at 5s. per cwt. would compare very favourably with ground barley or sharps each at 6s. per cwt.

Despite the fact that white fish meal was fed at the rate of 5 per cent of the control ration up to the time of slaughter, it is worthy of note that no cases of taint have been reported.

These experiments are still in progress. It is hoped that eventually most of the foods commonly used for pig-feeding in Great Britain will have been tested, and that rations will be found that are actually superior to the excellent control ration, which up to the present has proved the most satisfactory.

# RAAN OR BORON DEFICIENCY IN SWEDES

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The turnip in Scotland is heir to but few diseases. Until recent years the only trouble, other than Finger and Toe, of which much was heard, was Dry Rot, due to the fungus *Phoma Lingam.* Within the last decade, however, there have been numerous reports of a new and increasingly serious disease of swedes in the south-west of Scotland. This trouble is best known in Dumfriesshire and Galloway, where the term " Raan " has been applied to it.

Unfortunately, so far as is known, there is no means of detecting the presence of Raan until the bulbs are cut, and unless special search is made it remains unobserved until the crop is fed or sold for shopping. The symptoms are confined to the central portion of the bulb and do not extend into the neck, so that if only the upper part is cut the disease may escape notice. A cross-section of a bulb severely affected with Raan shows a clearly defined zone mottled with brownish areas, arranged according to no definite pattern (Fig. 1). In the case of a less severe attack the area involved may be merely a small patch or arc of tissue, having a water-soaked appearance and usually situated halfway between the circumference and the centre of the bulb. In a longitudinal section of the turnip the brown areas are seen to be elongated, converging towards the base and maintaining a fairly constant zone of healthy tissue between themselves and the rind. In very severe cases small cracks occur, marking the outer limits of the diseased zone. The turnip bulb is a complex body derived from the swelling of the upper part of the root and the lower part of the shoot. Symptoms of Raan appear to be restricted to the older zones of the root portion of the bulb and do not extend into the stem portion. When examined microscopically it is seen that the tissue involved follows the course of the vascular bundles. No parasitic organism can be detected in the tissues, but the brown discoloration appears to be associated with a slight swelling of the middle lamella of the parenchymatous cell walls. This is particularly noticeable at their angles.

Affected bulbs apparently keep well if lifted free from other diseases such as Dry Rot, that is, Raan alone does not result in a dry rot of the bulb. There is, however, some evidence to suggest that varieties susceptible to Raan are also those most liable to attack by the dry rot fungus, and that an attack of Raan renders bulbs liable to attack by feebly parasitic fungi such as *Fusarium spp.* It is worth noting that boron deficiency in sugar beet may result in a dry rot without the intervention of parasitic fungi (1) and (2).[1]

Although there is no actual loss in bulk, the feeding value of a Raan-affected crop is markedly decreased. Table I gives the results of analysis of cores taken from infected and healthy bulbs growing side by side in the field. Fifty cores were used for each analysis collected at Auchincruive, Ayrshire, in October 1933. The figures, other than the moisture content, are based on dry weight of the tissues.

TABLE I.

*Analysis of Healthy and Raan-affected Swedes*

(Furnished by courtesy of Prof. D. N. M'Arthur)

| | Variety | | | |
|---|---|---|---|---|
| | Dunedin | | R.34 | |
| | Sound Per cent | Affected Per cent | Sound Per cent | Affected Per cent |
| Moisture . . . . | 90·68 | 91·38 | 91·12 | 91·02 |
| Ash . . . . . | 8·16 | 10·01 | 7·12 | 8·33 |
| Oil . . . . . | ·59 | ·62 | ·44 | ·59 |
| Fibre . . . . . | 10·61 | 12·53 | 9·93 | 11·77 |
| Protein . . . . | 14·01 | 13·95 | 9·78 | 10·28 |
| Soluble Carbohydrates . | 66·63 | 62·89 | 72·73 | 69·03 |

It will be observed that there is an increase of approximately 2 per cent in the fibre content of diseased swedes, accompanied by a decrease of from 3 to 4 per cent in the soluble carbohydrates. The amount of sugar in the juice may be reduced by as much as 12 per cent. These changes taken together result in a serious reduction in the feeding value and palatability of diseased swedes. The difference in sweetness is often sufficiently marked to be detected if a small portion of the flesh is chewed raw, and when such swedes are boiled for human consumption they remain hard, stringy and tasteless. As a result Raan-affected crops are quite useless for shopping purposes.

Yellow and White-fleshed turnips apparently do not suffer from Raan, and even amongst swedes there is considerable difference in the degree of susceptibility of varieties. During the last three years an attempt has been made to gain some information on this head and the results so far obtained are given in Table II.

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[1] These references are to the authorities in the list at the end of the article.

TABLE II

*Percentage Raan in Swede Varieties*, 1932-34

| Variety | Grown at Milton, Kirkcudbrightshire | | Grown at Auchincruive, Ayrshire | | |
|---|---|---|---|---|---|
| | 1932 | 1933 | 1932 | 1933 | 1934 |
| Argyll | .. | .. | .. | 35 | 10 |
| Bangholm | 60 | .. | 24 | 45 | 10 |
| Best of All | 10 | 12 | 8 | 10 | 0 |
| Conqueror | .. | .. | 28 | 15 | 20 |
| Dwarf Purple Top | .. | .. | 60 | 54 | 20 |
| Dunedin | .. | .. | .. | 70 | 25 |
| Enterkin | .. | .. | 12 | 20 | 0 |
| Garton's White-fleshed | .. | .. | .. | .. | 0 |
| Golden | .. | .. | .. | 0 | 0 |
| Elephant | 30 | .. | 16 | 20 | .. |
| Halewood | .. | .. | 4 | 15 | 10 |
| Kelvin | 28 | .. | .. | 5 | 0 |
| Knockdon | .. | .. | 16 | 15 | 12 |
| Magnificent | 22·5 | 43 | .. | .. | .. |
| Masterpiece | 30 | 36 | .. | .. | .. |
| Monarch | .. | .. | .. | 45 | 20 |
| Monkwood | 85 | 64 | .. | .. | .. |
| New Balmoral | 20 | 44 | .. | .. | .. |
| Peerless | 35 | 36 | .. | 35 | .. |
| Picton | 30 | 36 | 24 | 35 | 35 |
| PM.33 | .. | .. | .. | 50 | 10 |
| R.34 | 35 | 16 | .. | 30 | .. |
| Scotia | .. | .. | 20 | 15 | 15 |
| Springwood | .. | .. | 12 | 55 | 10 |
| Tipperary | 20 | 16 | .. | .. | .. |
| XL All | .. | .. | 24 | 15 | 20 |

In addition to the above a number of other varieties were included once in one or other of the trials, but are not listed in the Table in order not to swell it unnecessarily. They were : Empire, Imrie's Imperial, Kinaldie, Kyle, Locarno, Nonsuch, Purple Top P.320 and B.302, Skirving's, Superlative, and Victory. None of these proved resistant to Raan.

It will be noted that on the whole a higher percentage of disease was recorded in Kirkcudbrightshire than in Ayrshire, and that the degree of infection varies from year to year.

Unfortunately, varieties of swedes, like those of other Brassicæ, are somewhat unsatisfactorily defined or fixed, and it is by no means certain that all strains of a widely grown variety will behave in the same way. It appears, however, that all the Purple-topped types are susceptible in varying degrees, with the possible exception of Garton's White-fleshed. This variety was only grown in a single year, and that was one in which the percentage of Raan recorded was not so high as usual. It should be pointed out, however, that the drill of this variety was subjected to much more searching inspection than that of any other except Golden, without any trace of Raan being detected. The position in regard to Golden is more satisfactory, as it was grown two years in succession and proved completely free from the disease in each case.

It is important to observe, however, that we are dealing only with a question of relative resistance, not of immunity. Consequently, under adverse conditions, even a relatively resistant variety will not escape the disease. Thus a case has come under our observation where in the present year, one extremely favourable for the development of Raan, a field of Golden showed 78 per cent disease. The field had been heavily limed during the previous winter. (See page 331.)

It may be mentioned here that there appears to be some correlation between the degree of susceptibility of a swede to Raan and the extent of its root system. To test this hypothesis six bulbs were drawn at random from some of the varietal test plots at Auchincruive, 1934, and the proportion of root to bulb determined by weighing. In the case of four varieties, one regarded as resistant, one as very susceptible and two as moderately susceptible, the proportion of fibrous rootlets to main roots was also determined. As a check on the reliability of the figures, all determinations were made in duplicate in the case of these selected varieties. The results are given in Table III.

TABLE III

*Relation between Root Development and Susceptibility to Raan*

| Variety | Weight of 6 Bulbs and Tops lb. | Fresh Weight of Root System grammes | Proportion of Root to Bulb per cent | Fibrous Roots to Main Roots per cent | Raan (Average 1933-4) per cent |
|---|---|---|---|---|---|
| Dunedin | 30<br>29½ | 56·05<br>60·20 | ·412<br>·449 | 8·29<br>8·63 } 8·46 | 47 |
| Picton | 36<br>39 | 67·00<br>54·23 | ·408<br>·306 | 10·22<br>13·11 } 11·66 | 35 |
| Springwood | 32½ | 69·20 | ·406 | .. | 32 |
| PM.33 | 31 | 54·40 | ·386 | .. | 30 |
| Argyll | 27 | 62·68 | ·501 | .. | 22 |
| Elephant | 41 | 49·03 | ·263 | .. | 20 |
| Conqueror | 36 | 77·92 | ·476 | .. | 17 |
| Best of All | 33<br>38½ | 79·85<br>84·30 | ·532<br>·481 | 8·49<br>12·04 } 10·26 | 5 |
| Garton's White-fleshed | 44 | 132·12 | ·666 | .. | 0 |
| Golden | 35<br>26 | 122·55<br>72·90 | ·770<br>·618 | 13·87<br>20·79 } 17·33 | 0 |

According to the percentages in the above table it appears that the resistant swede varieties possess a much greater root system than do non-resistant varieties. The results also indicate that in resistant strains the amount of fibrous roots is increased out of proportion to the increase in the weight of root system as a whole. Since, as will be shown later, Raan is due to deficiency of an essential element in the soil, this is perhaps what might have been expected. All other things being equal the plant with the biggest root system is that which would be able to extract the maximum amount of nutriment from the soil. Results of culture experiments, however, seem to indicate that one effect of boron deficiency on swedes is to reduce the production of fibrous roots. It remains, therefore, an open question whether the small root development of susceptible swede varieties is a cause or an effect of their susceptibility to Raan.

Fig. 2 shows typical root systems of Dunedin and Golden, the former very susceptible to Raan and the latter resistant. The mass of fibrous rootlets obtained from a bulb of each variety is also shown.

Raan occurs in every county in the south-west of Scotland, but is known to be most severe in Dumfriesshire and Kirkcudbrightshire; it is probably also an important factor in parts of Argyll and Dunbartonshire. In Ayrshire it appears to be on the increase. It is also known to occur sporadically in the Lothians. Outside of Scotland it is recorded from Wales, Ireland, New England, Canada (except the prairie provinces) and New Zealand.

In all these areas boron deficiency in turnips has only become of economic importance during the last decade. The reason for this is obscure but it is perhaps plausible to see a connection with the increased use of artificial fertilisers to replace dung and with increased chemical purity attained in the manufacture of these fertilisers during late years.

*Cause and Control of the Disease.*—Symptoms of Raan are often confused with frost injury, and it is not easy to recognise slightly infected bulbs after they have been exposed to a severe frost. In general, however, it may be said that Raan mottling can be recognised by its presence in a ring round the centre of the bulb and its absence in the marginal zone. Frost, on the other hand, always affects the outside first. That there is no connection between the two types of injury is shown by the fact that Raan can sometimes be detected in swedes at the end of July, when they are only about two inches in diameter, and that infection amounting to 70 per cent was detected in one field in Kirkcudbrightshire on 15th August 1935, long before any frost had been recorded.

No fungi are associated with the disease.

Colonies of one particular type of Bacterium are readily obtained from diseased tissue, even when great care is taken to exclude chance contaminants. Inoculation of swedes from pure cultures of this organism, however, produces no trace of the disease and it is evident that its presence in the tissues is of little significance.

Once these points were established it was thought probable that Raan might be a deficiency disease. Further indications that this was the case were afforded by the effects of dunging and liming on its incidence. Heavy applications of dung are reported to be beneficial in reducing the percentage of affected bulbs. Interesting information on this head is given by Hurst (5), in a paper written when the cause of the disease was still obscure. Hurst found " that brown heart was consistently absent where the rows crossed the former sites of two manure heaps." In pot tests, however, he found that a rate of about 30 tons of well rotted manure per acre was required to eliminate the disease completely. Farmyard manure, from its complex composition and origin, might be expected to contain numerous elements not included in artificial manures and therefore to be of value in checking diseases due to small mineral deficiencies.

The effect of liming is even more interesting. It is well known that heavy applications of lime render manganese already present in the soil unavailable to the plant roots (7), and bring about manganese deficiency symptoms in oats. Similar relations between liming and the development of symptoms of boron deficiency in sugar beet are recorded by Brandenburg (1). In the West of Scotland it is a common experience in farming practice that a heavily limed field yields a high percentage of Raan-infected swedes.

Manganese deficiency in oats is widespread in the College area and this fact, together with the parallel reaction to liming, led to its being considered possible that Raan was a manganese deficiency in turnips. It is unnecessary to describe in detail the experiments that were carried out to check this hypothesis. Suffice it to say that manganese proved to be an essential element, in that swede seedlings grown in well aerated culture solutions in the absence of manganese and presence of boron remained very small, and failed to grow beyond the sixth or seventh leaf. Larger seedlings transplanted to culture solutions from which manganese was omitted similarly ceased growth, but developed no clearly definable symptoms and showed no sign of Raan. Applications of manganese sulphate at the rate of 1 lb. to 50 yards of drill (approximately 1 cwt. per acre) completely failed to control the disease. Applications of a basic slag containing 3 per cent manganese (as $MnO_2$) applied at a rate of 10 lb. per 50 yards of drill apparently produced some effect, though in this plot the control drills also showed a lower disease percentage than usual. Probably the low percentage in the control drills was due to leaching from the treated ones between them. Each experimental plot consisted of ten drills (variety Knockdon), every other drill being treated while the five intermediate drills were left as controls. The manures were applied soon after singling. The results obtained are expressed in Table IV.

### TABLE IV

*Effect of Manganese on Raan*

| | Plot 1 | | Plot 2 | | |
|---|---|---|---|---|---|
| | Manganese Sulphate | Untreated | Slag | Untreated | Remainder of Field |
| | Per cent | Per cent | Per cent | Per cent | Per cent |
| Healthy Swedes . | 81·5 | 83·0 | 96·6 | 93·9 | 83·6 |
| Raan-affected . . | 18·5 | 17·0 | 3·4 | 6·1 | 16·4 |

The possibility of a deficiency of boron was next considered and our attention was drawn by Dr H. T. Güssow, Canadian Dominion Botanist, to the work carried out since 1928 at Charlottetown, Prince Edward Island, where a disease called "Brown Heart of Turnips" had been shown to be controllable by applications of borax. Exchange of photographs of diseased specimens with Dr Güssow showed that "Brown Heart" is the same disease as that known to us as "Raan." In view of the approaching publication of the Canadian results (6), it is unnecessary to give more than a cursory account of our own experiments.

In water culture solutions (van der Crone's solution plus ·005 grm. $MnSO_4$ per litre) without boron, turnip seedlings remain very small, take on a pale yellowish-green appearance, and die after about three months' growth. At this time they weigh about $\frac{1}{20}$ as much as plants grown in the complete solution plus ·005 grm. borax per litre. When older plants are placed in similar well aerated solutions those lacking boron cease growth after about a month. The already formed heart leaves remain healthy and green but the terminal bud itself dies and turns brown. The most striking feature, however, is the absence of fibrous root development. The plants lacking boron develop a single tap root crowded in the upper part with short laterals, never over $\frac{1}{2}$ inch long, but up to 1mm. thick, all very noticeably pinkish-brown in colour. Plants grown in the complete culture solution, on the other hand, developed masses of much branched white fibrous roots. Typical root systems from these cultures are shown in Fig. 3. In none of these experiments were any specific foliage symptoms of boron deficiency observable. This is in accordance with field experience where no external symptoms of Raan appear. None of the seedlings grown in water cultures without boron attained sufficient size to exhibit mottling of the flesh.

At a number of centres where Raan was known to occur, field experiments were laid down in which the effect of borax in preventing the disease was tested. The borax was applied at the rate of 20 lb. per acre before the seed was sown.

Definite results cannot be quoted until the crops have completed their growth, but preliminary results based on surveys made at the end of August are already to hand from two centres (Table V).

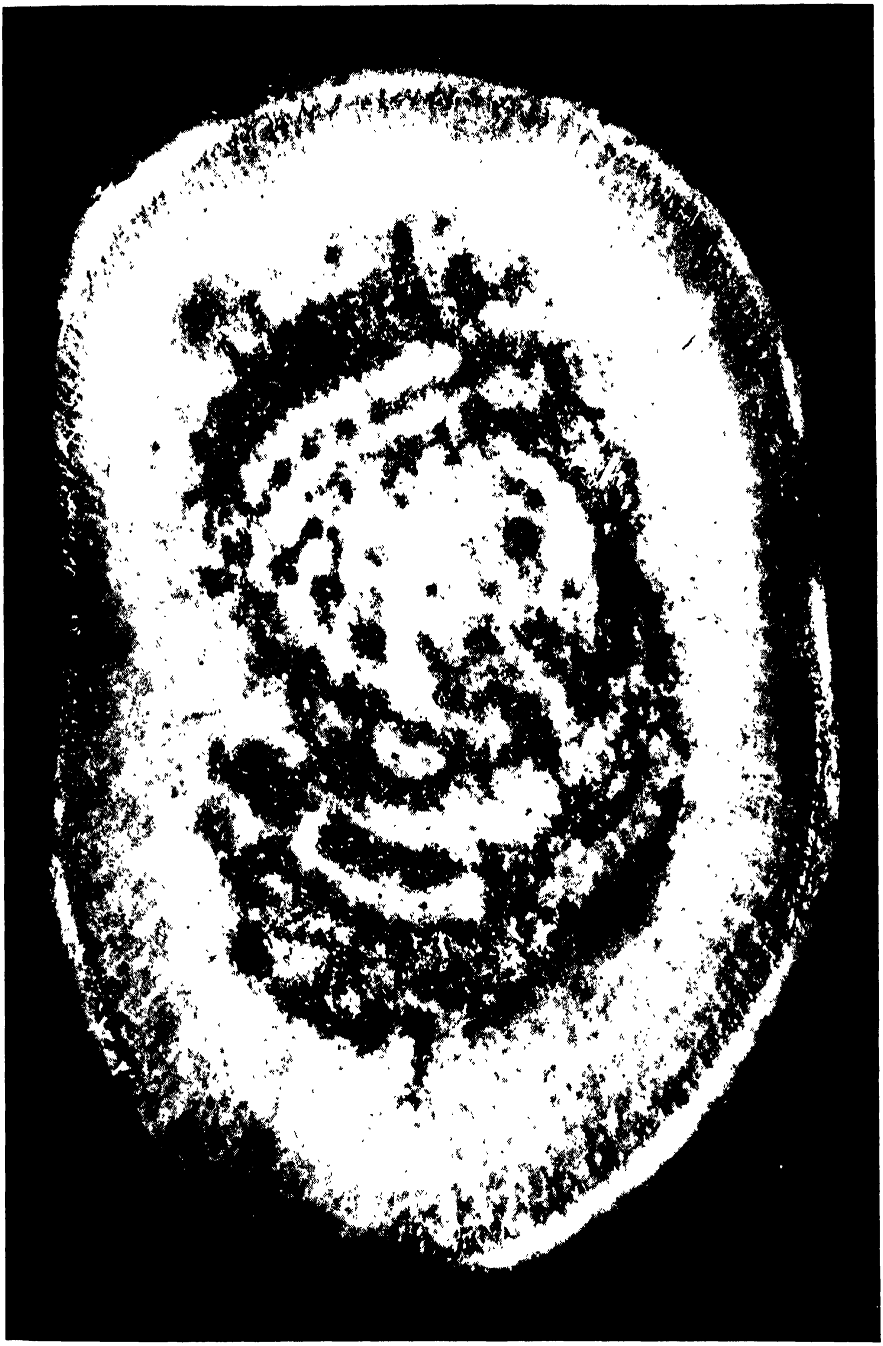

FIG. 1.—Cross section through lower half of a Swede affected with "Raan."

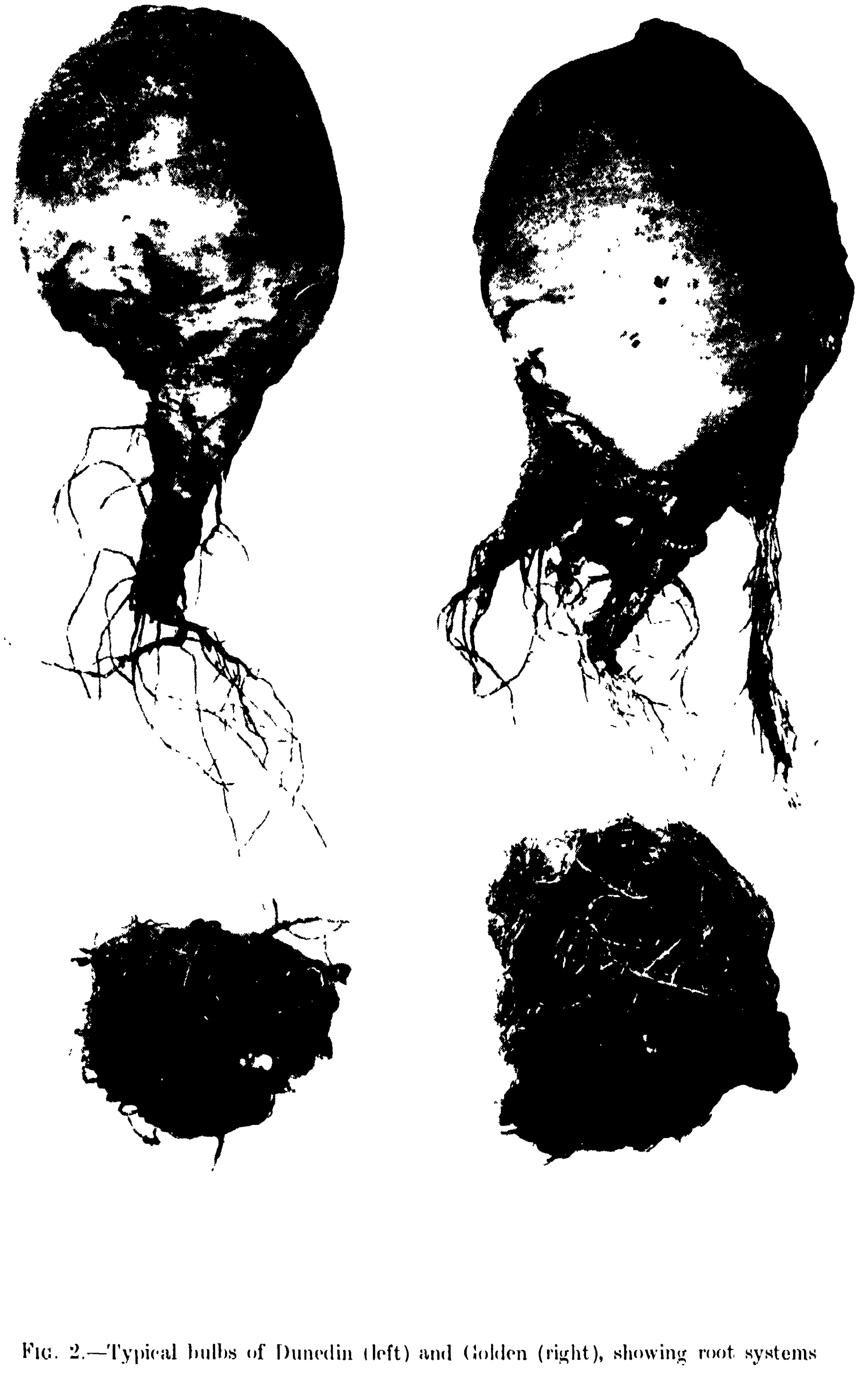

FIG. 2.—Typical bulbs of Dunedin (left) and Golden (right), showing root systems

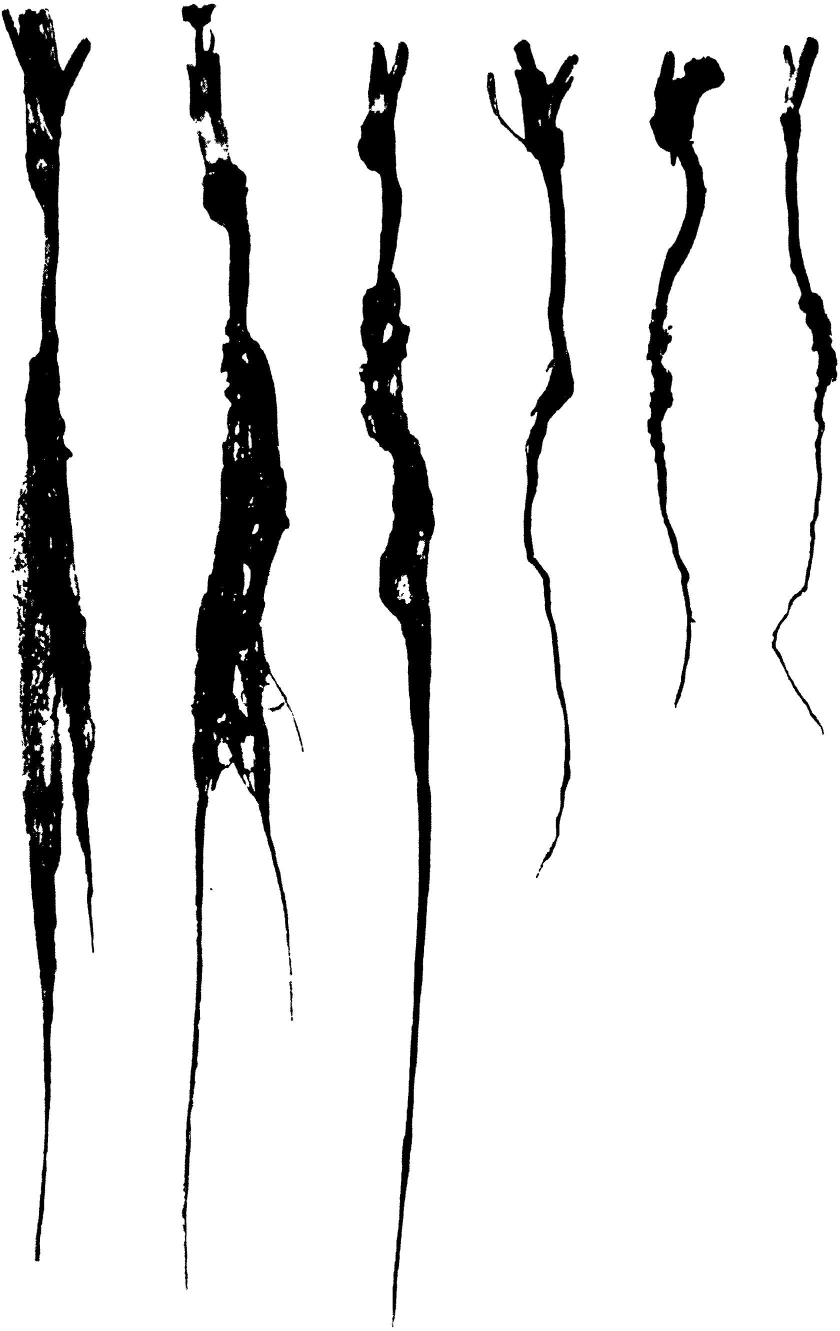

FIG. 3.—Typical Swede root systems obtained in water culture. Left—complete solution with Boron. right—without Boron.

### TABLE V

*Effect of Borax in Controlling Raan of Swedes in the Field*

| County | Per cent Raan Untreated | Per cent Raan 20 lb. Borax per acre |
|---|---|---|
| Kirkcudbrightshire . | 70 | 0 |
| Dumfriesshire . . | 40 | 0 |

Further experiments are required to show whether a single application of borax at the time of sowing will suffice to control Raan completely until the time of pitting, and also to determine how much borax the turnip crop can stand. There are records of grave injury to certain crops, especially potatoes (3) and (9), as a result of excessive amounts of boron in the soil, or of uneven distribution of borax applied in fertilisers.

At present it appears that turnips, beet and cereals are fairly tolerant to boron, but it is probable that injury will result if borax is applied unevenly even to these crops. Canadian workers recommend mixing the chemical very thoroughly with five to six times its weight of dry sieved earth (6). They also advise that the mixture be thoroughly raked in to avoid concentrating the boron in any one place, and that the treated area be left for three to four days before planting. In Germany it is recommended that the difficulty of even distribution in the field be overcome by applying borax in solution by means of a Charlock sprayer (8). In our experiments described above, the borax had been intimately mixed with finely powdered inert filler at the rate of 20 lb. per cwt. One hundredweight per acre is the least amount which can be evenly sown in practice.

For these reasons farmers are warned not to apply borax at present at rates higher than 20 lb. per acre and to mix this amount with some finely divided inert substance to raise the bulk to at least one cwt. per acre before using. Owing to difficulties in mixing, it would obviously be most satisfactory to have the borax incorporated with the filler by mechanical mixers if possible. In this connection it may be mentioned that we have been informed that a preparation is to be placed on the market in which both borax and manganese are incorporated with an inert material so as to render it safe to sow 1 to 2 cwt. of the mixture per acre. We understand that this preparation will be sold under the name of "Terravit."

It would appear inadvisable for manure merchants to make a practice of incorporating borax with their manures except in specific cases at the request of clients. Different farmers are in the habit of applying very different amounts of artificial manures to their crops, and if a definite percentage of borax is incorporated in a manure the man who "does his land well" will be in danger of introducing toxic amounts of boron into the soil. Moreover the boron requirements of different crops and different soils vary widely.

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# A GREAT AGRICULTURAL IMPROVER—LORD KAMES

ALEX. M'CALLUM, O.B.E., M.A., LL.B.

IN previous papers in this JOURNAL attention has been called to the part played by landowners in initiating and forwarding the movement for improving Scottish agriculture which marked the middle of the eighteenth century. Among these enlightened leaders none was more outstanding or more enthusiastic than Henry Home, Lord Kames. His biographer, Lord Woodhouselee, says of him : " He was intimately associated with every species of improvement, whether of an intellectual or a political (*i.e.* social) nature that took place in Scotland during his age."

Henry was the son of George Home of Kames, in Eccles parish, Berwickshire, and he was born there in the year 1696. The family was connected with the Earls of Home, and, on the mother's side, Henry was the great-grandson of Robert Baillie (1599-1662), a member of the Westminster Assembly and afterwards Principal of Glasgow University. His father appears to have been rather a feckless person, and the family estate in his hands fell into an impoverished condition. Henry was accordingly not sent away to school, but was taught at home by an inexpensive tutor who, one gathers, was more feared than respected by his pupil. In 1712 the young laird was indentured to an Edinburgh writer, and he soon realised that his future must depend on his own ability and resource. Having been sent on some legal errand to the house of Sir Hew Dalrymple, then President of the Court of Session, and seeing the elegance of his style of living, Home is said to have been inspired thereby to think of a career at the bar ; and realising the deficiencies of his general education, he set himself to study assiduously classical and modern languages, physical sciences and philosophy, as well as the strictly professional subjects of his law course. He was called to the bar in January 1723; in February 1752 he was appointed one of the Judges of the Court of Session, taking the judicial title of Lord Kames; and in April 1763 he became one of the Lords of Justiciary, the supreme criminal tribunal in Scotland. Such in brief was his professional career, and it is a record of remarkable success, achieved solely by natural ability and unremitting labour.

Home was an earnest student of the law of Scotland, and he wrote several treatises on branches of the subject, all marked by a persistent endeavour to relate practice to principle and to find a philosophic basis for civic law.

Brilliant as a lawyer, he was no less distinguished in other walks of life. As thinker and writer on philosophy he enjoyed the friendship of and was in regular and intimate correspondence with David Hume, Thomas Reid and other notabilities of the Scottish School; Benjamin Franklin, the American diplomat and economist, was his personal friend; Adam Smith, author of *The Wealth of Nations*, admitted his great indebtedness to Lord Kames, saying, " We must every one of us acknowledge Kames for our master." His lordship even crossed swords with the great Frenchman Voltaire, who, smarting under a home thrust in the Scotsman's attack, dubbed him " Mackames."

His works included treatises on "The Elements of Criticism," on "Education" and on the "History of Man." Indeed his versatility of mind, the range of his interest and the extent of his knowledge were remarkable.

His personal peculiarities, moreover, were such as to make him an outstanding character in the social life of Edinburgh. His tall spare figure and his keen legal face are familiar to us in Kay's *Portraits* and in other presentments; and many stories have come down to us of his shrewd insight into character and of his caustic comments on the foibles of his fellow-citizens. It was a couthy, homely community, that of the good town of Edinburgh in the eighteenth century, when everybody knew everybody, and social life was simple, speech plain or even to modern ears coarse, and manners hearty and free. It was a type of life which exactly suited Henry Home's temperament, and he took his share in it with a zest and enjoyment which were obviously whole-hearted. He was fond of practical jokes, and frank and outspoken in his broad humour. Even when seated and robed as a judge he occasionally expressed himself more frankly than modern taste would consider seemly. At Ayr in 1780 he was on the bench when a former acquaintance of his—Matthew Hay, with whom he had often played chess—was being tried for murder. When the foreman of the jury intimated a verdict of "Guilty," Lord Kames leaned forward and with grim humour remarked to the prisoner: " I doot that's checkmate for you, Mattha." But the score was not always in his favour. When he asked his colleague, Lord Monboddo, whether he had read his latest book, Lord Monboddo replied acidly, "No, you write a great deal faster than I am able to read." He was indeed a copious writer: his recipe, given to Sir George Elliot, for getting information on any subject was to write a book on it. He was a prominent member of the leading social and philosophical clubs in Edinburgh—such as the Rankenian, which met in Ranken's Tavern to debate on philosophical problems; the Select Society formed to promote literary discussion and oratory; and the Philosophical Society, of which he was the founder and which was the forerunner of the Royal Society of Edinburgh. He remained active and keen in body and mind throughout his long life, and he and his capable and sensible wife, Agatha Drummond, made their house in New Street a centre of kindly hospitality for the intellectual groups of the town.

When the Court of Session rose for the Christmas recess in 1782, Lord Kames bade a cordial good-bye to his colleagues individually, and then, taking a last look round the familar court-room, he added in his characteristic, broadly humorous way: "Fare ye a' weel, ye bitches." He died eight days afterwards, eager, as he told his doctor before the end, to discover what work would be given him to do in the future state.

Interesting as are the records of his professional, philosophical and social activities, our concern is rather with his untiring efforts to improve the agriculture of his time. He himself gives a vivid picture of its deficiencies, and he was doubtless moved also by the wretched condition of his own patrimonial estate when it came into his hands, and by the contrast it presented to the state of things he had observed south of the Border. He gave his acute mind to the practical pursuit and the scientific study of agriculture, and he took every opportunity of discussing problems of plant life with acknowledged authorities such as Dr Joseph Black, Professor of Chemistry, and Dr John Walker, Professor of Natural History, both in the University of Edinburgh. He was among the first of the Scottish gentry to introduce and demonstrate the newer methods of farming on his own estate, and he was no mere theorist for he was wont to supervise and even to take a personal share in the labours of the field.

Wider opportunity came to him when in 1766 his wife succeeded to her brother's estate of Blair-Drummond in Kincardine parish, Perthshire. Thereafter much of his leisure was spent in devising and carrying out agricultural improvements there—draining, enclosing, summer-fallowing, green-cropping, trying out grass mixtures, planting trees, garden-making, constructing roads and bridges, and generally adding to the value and amenity of the property. The estate included about 1,500 Scots acres of the Moss of Kincardine. Lord Kames discovered that the moss, eight or nine feet in thickness, rested upon a subsoil of rich clay similar to the soil which prevails in the Carse of Stirling and Falkirk. In the moss itself were found many trunks of oak and other trees believed, from the evidences found, to have been felled by Roman soldiers in the first century A.D., the inference being that the peat had been deposited on the fertile soil subsequent to that time.

To Lord Kames's active mind the idea quickly occurred that if the overlying moss could be got rid of, the carse soil underneath would become a valuable agricultural asset, and he accordingly evolved a scheme whereby the peat was to be removed in bits and floated into the River Forth by ditches cut through the moss. The plan adopted to get this carried out is described in Dr Walker's *Report on the State of the Highlands and Islands*. Portions of the moss in eight-acre lots were let to tenants on a lease of thirty-eight years. Each tenant was supplied with sufficient timber to build a house and two bolls of oatmeal to support him while building it. For the first seven years the tenant paid no rent; for the eighth he paid one merk Scots (13⅓ pence sterling), for the ninth, two merks, and so on with the addition of one merk yearly up till the end of the first nineteen years. On the commencement of the second term of nineteen years he began to pay a yearly rent of 12s. for each acre of land cleared and 2s. 6d. for each acre uncleared. "Upon these terms," says Walker, "this extensive tract, which scarce ever before could feed anything but a muirfowl . . . is now peopled with 620 inhabitants who raise valuable crops of grain beside other productions. From mean hovels they have now got into good brick houses. They have cattle and carriages in abundance, and form a colony of industrious, virtuous and happy people." Actually about 500 acres were reclaimed during the lifetime of Lord Kames. His method, however, was very laborious, and an improvement was introduced by his son and successor, George Home Drummond. The main problem was to get a run of water in the ditches sufficient to carry the moss down to the river, and it was solved by the employment of a water-wheel devised and constructed by George Meikle of Alloa, son of the inventor of the threshing-machine. This wheel raised water from the river to a height of 17 feet and poured it into a trough from which it was led to reservoirs in the moss; thence it could be run off into the ditches as wanted. The moss was dug out by spade and thrown into the ditches. Wheel, pipes, water-channels, all were finished in 1787 at a cost of £1,000, and the whole moss was cleared by 1839.

Apart from demonstrations of new methods given on his own estates, Lord Kames found opportunity of exercising a beneficent influence on Scottish agriculture in other ways. In 1755 he was appointed a member of the Board of Trustees for the Encouragement of the Fisheries, Arts and Manufactures of Scotland; and in the same year he was nominated one of the Commissioners for the management of the Forfeited Estates annexed to the Crown after the Jacobite rebellions. In both of these capacities he was able to indulge his zeal for improvement by encouraging the introduction of new implements designed to lighten manual labour and make it more efficient, by stimulating efforts at reclamation and afforestation, and by promoting the breeding of better live stock.

He was a great believer in the value of a skilled survey of existing conditions as a preliminary to suggestions for betterment, and it was due to his motion that Dr John Walker, later the Natural History professor noticed above, was appointed by the Commissioners for the Annexed Estates to make a survey of the Western Isles, with a view to the improvement of the neglected herring fishery and of agriculture and pastoral farming, and the introduction or development of suitable industries. Walker's journeyings lasted seven months, covered 3,000 miles of sea and land, and resulted in an elaborate report with detailed suggestions for improving the social conditions of the Islands and the Western Highlands. It has been quoted from above.

Another survey suggested by Lord Kames was that carried through with the object of obtaining a correct and particular account of the Forfeited Estates, the actual situation of each, the character of the soil, the methods of culture, the crops commonly grown, the manures used and those which the soil might furnish and nature supply, the prices of labour and provisions, and in general any information which might tend to hint possibilities of increase in agricultural output. On his lordship's proposal the contemplated survey was entrusted to an intelligent and active farmer, Andrew Wight of Ormiston, East Lothian. Wight's reports, submitted in 1773 and 1774, were so satisfactory that he was asked to extend his survey to other counties than those in which the Forfeited Estates were embraced, and as a result six volumes of reports on wide areas, mainly in the northern counties, were compiled, and in all likelihood would act as a powerful stimulus to improvement.

Another favourite plan of Lord Kames was the setting up of a Board of Agriculture in Scotland. This was not a new idea : in previous articles we have noted its advocacy by Mackintosh of Borlum and by Maxwell, Secretary of the Society of Improvers.[1] But Kames supported the proposal with his usual energy and enthusiasm and made definite suggestions for carrying it into effect. The Board, he thought, might consist of nine members, men of known ability and skill in rural affairs, and patriotic to the extent that they would give their services without fee or reward. Other men with special knowledge might be called into consultation as occasion arose. The Board should have a secretary with an adequate salary—which his lordship puts at from £100 to £130 a year. They should meet monthly or oftener if found necessary. Their first duty would be to draw up a complete statement of the style of husbandry practised in the different counties, noting particulars of climate, soil, mode of cropping, implements and the prices of all items that enter into farming economy. Then they should issue instructions for improvements suited to the soil and local conditions, with special reference to present practice, showing wherein it is deficient and putting forward the most efficacious corrections.

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[1] *Scot. Jour. Agric.*, vol. xvii, pp. 172, 372 (Apr. and Oct. 1934).

To carry out these aims the Board should appoint an inspector to give instruction supplementary to the general directions issued in writing, and to report the progress made. They should award medals and other premiums, such as ploughs, harrows and carts, to the best conducted farms or to those where progress was most evidently being made. They should act as an advisory body to answer inquiries addressed to them by landlords or farmers. They should examine new inventions relating to husbandry and should publish their findings. They should carry out experiments thus : "Let lists be made from time to time of the points that are capable to be ascertained by experiments ; let proper experiments be suggested ; let these experiments be distributed among persons of skill ; and when their success is reported the conclusions that may be drawn from them ought to be published. This would be the most effectual method that has ever been contrived to ripen knowledge in husbandry."

The Board should likewise encourage the publication of useful essays on agricultural subjects, and they should issue an account of their own transactions yearly. The expense of all this activity was to be met by a modest annual grant of £500, in addition to the sum allowed for the secretary's salary.

There is a refreshingly modern touch in the whole design—except in regard to finance !

Lord Kames suggested the same plan for England, and, although neither proposal was given effect to at once, his powerful support was probably more than helpful in bringing about the establishment by Pitt in 1793 of the Board of Agriculture for the whole kingdom, with Sir John Sinclair as President and Arthur Young as Secretary.

Credit too may be given to Lord Kames as the direct instigator of academic teaching of agricultural science. When his friend Cullen became Professor of Chemistry in the University, Kames pressed him to give some lectures on science related to agriculture. These were followed by a series given by Professor Walker, also at the urgent solicitation of Lord Kames, and so led on to the foundation of the Chair of Agriculture in 1790.

What we may regard as his lordship's final and most notable effort to promote the agriculture of his country—it appeared when he was in his eightieth year—was the compilation and publication of *The Gentleman Farmer, being an Attempt to improve Agriculture by subjecting it to the Test of Rational Principles.* It embodied the conclusions drawn from his wide reading of agricultural treatises, his discussions with his scientific and philosophic friends, his observation of practical methods both north and south of the Border, and his own experience of farming.

In soliciting the patronage of the Royal Society for the publication, he avowed that it was his fervent desire to be useful to his country. The work was accepted and sponsored by the Society; a copy was presented to King George, who complimented the author and was glad to hear that agriculture was making such progress in Scotland. The book at once obtained a wide circulation; six editions were issued from Edinburgh between 1766 and 1815; and according to contemporary evidence it had a remarkable influence in diffusing agricultural knowledge and in prompting to new experiments.

The title of the book is significant. The Scottish tenant farmers of the day were poor, ignorant and apathetic; in many districts, having seen no better farming than their own they had no notion of any better. The writer accordingly addresses himself in the first instance to the landowners, and asks whether they can be employed more beneficially for their country or more honourably as well as profitably for themselves than by rousing emulation among their tenants, by kind treatment, by instruction, by example and by premiums. They are to study the rules set forth in the book and endeavour to get their tenants to follow them.

So great has been the advance in our knowledge of chemistry and biology in the last hundred years that we are not surprised to find the "rational principles" to which the author subjects agricultural practice rather out of date nowadays. His main principle appears to be that plants are endowed with powers to imbibe juices, to alter these juices into sap, and to convert the sap into their own substance. The function of the soil in plant life is to retain moisture and to furnish it to the plant gradually as required. This function of the soil is conditioned by the size of the particles composing it, and the object of cultivation is to obtain the optimum size of particle for this purpose; that is, we must pulverise the soil into loose particles so that it may retain the right amount of moisture for plant growth at its best. Tull is criticised for saying that plants ingest and live on the pulverised earth itself, since this can be disproved by the growth of plants in pots without loss of weight of soil. The conclusion is reached that air and water are the constant and inexhaustible sources of the food of plants, enriched it may be by various substances dissolved in them, and stimulated by sunshine. The green colour of plants is occasioned by an "oily substance" which can be separated by a chemical operation; and that oily substance must be elaborated by the sun's action, for no plant is green when sunlight is excluded.

According to the theory, then, the difference between a fertile and an infertile soil is mainly a question of ability to retain moisture for plant nourishment, and therefore the means of fertilising a soil are ploughing, harrowing and rolling, manuring, marling and liming. Indeed the effect of manuring seems to be mainly its relation to the soil particles as helping either to retain moisture or to reduce its excess.

This theoretical exposition is really the second part of the treatise; the previous part is a *vade mecum* for the farmer. It deals first with the implements of husbandry, criticising the clumsy appliances then in use and urging the utilisation of the lighter and more efficient modern inventions. It treats of farm animals, stressing the need for greater size and strength, to be attained only by better breeding and feeding. We note that Lord Kames was a strong believer in the usefulness of the ox as a draught animal, especially on the small farm. The work goes on to describe the proper layout and construction of a steading, economy in building costs and convenience in working being the main features to be kept in view.

Then we pass on to directions for breaking in land for cropping, and incidentally are given a vivid glimpse of the rough state of much of the land throughout the country—stony ground, marsh, moorland, and stretches covered with broom and whin. The detailed instructions for keeping down weeds are significant.

The various crops are dealt with in turn, and special attention is given to turnips and potatoes and to the sowing out of grasses, the inference being that Scottish farmers specially needed instruction about these newer practices. It is interesting to note Lord Kames's opinion that white clover is for pasture the best " grass " known in Britain, and also his advocacy of a good seeds mixture for spreading out the feeding capacity of a pasture over the season.

In discussing rotation of crops the author distinguishes between " culmiferous " crops, such as wheat, which rob the soil; " leguminous " crops, such as pease, which get most of their food from the air; and " bulbous " crops, like turnips, which break up the soil. Accordingly, he argues, a succession of these three sorts of crops is best, and he gives a series of rotations to suit different conditions.

The instructions for stall-feeding of cattle are elaborate, as this was then a practice new to the Scottish farmer, while as regards the disposal of the beasts when fed, Lord Kames pleads strongly for sale by weight, and even suggests regular weighings during the feeding period. Incidentally also, he urges that corn should be sold by weight and not by measure, as was then universally the case.

Further sections treat of the planting and care of trees, manures, fences and the proper size and equipment of an arable farm. In regard to the last point, Lord Kames believes that the smallest farm should have enough land for one plough team, and that the next size should have sufficient for two teams, character of soil and mode of cropping being taken into consideration. From the national point of view—looking to the number and the health of the population—he thinks small farms better than large, and he would accordingly tax farms of excessive size.

His treatment of manures is naturally least satisfactory from our point of view ; nevertheless he had prevision of the part artificial manures were likely to play in the future economy of the farm. So convinced was he of the changes chemistry was to bring about that he told one of his tenants how he might one day be able to carry the manure sufficient for a whole field in his coat-tail pockets. " Aye," was the dry response, " an' nae doot ye'll can bring back the crap in yer waistcoat pooch."

From our later point of view much of the matter contained in the *Gentleman Farmer* appears to be simple and elementary ; much of it too has lost its urgency, and its " rational principles " are somewhat antiquated ; nevertheless the book can be read with interest and advantage even to-day, and in its own time it was certainly worthy of the respect and authority which it long enjoyed.

Scotland was fortunate in its leaders in the movement for a better national agriculture, and none of them was more enthusiastic, none more influential in his day than Henry Home, Lord Kames.

# ATTEMPTED IMPROVEMENT OF THE BLACKFACE SHEEP IN ZETLAND

IAN E. SANDISON

THE word " improvement " has no precise meaning when applied to our domestic animals, for what is a forward step to one man often appears a backward step to his neighbour. This is particularly the case with regard to the Blackface sheep. It is well known that many flockmasters believe the show-yard or sale-ring to be the only test of merit, while others hold that such a test is having a bad influence on the breed.

The Blackface sheep has a history of outstanding hardiness. Writing in the *Transactions of the Highland and Agricultural Society* for 1884, Mr David Archibald said : " Occasionally in trying seasons, there is no course except to give the sheep a little hay, but this the blackfaced require rarely in comparison with the Cheviot which are much less self-reliant and active." [1] That writer appreciated the necessity of preserving this valuable characteristic, for in the same article he said : " Any change in the breed which would in the smallest affect its hardiness is to be strongly guarded against." [2]

The Blackface is still our great mountain sheep, for it has recently been estimated that there are seven of this breed on the hills for each Cheviot.[3] This is due to its natural ability to thrive and produce first-class mutton on ground where other breeds would fail. But this characteristic is being overlooked by many breeders at the present time.

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[1] *Transactions*, Fourth Series, vol. 26, p. 237.

[2] *Ibid.*, p. 240.

[3] Professor J. A. Scott Watson in *Transactions*, Fifth Series, vol. 44, p. 12.

Ten years ago, when considering the possible improvement of my flock of 400 Blackfaces on the farm of Houlland in Unst, the most northerly island in Britain (latitude 60° 45′), I asked myself if I could ensure success by continuing with the fed sheep of the show-yard or sale-ring. I bore in mind that I had to aim at the animal which could turn out economically the type of carcase the consumer was willing to buy.

I had up to this time accepted what I considered to be the general method of improvement of a flock of Blackfaces, namely the buying of a handsome sire whose ancestors had been well bred and fed for generations, and of some nice-looking female sheep, which in most cases no doubt owed their appearance to the same source as that mentioned for the sire, and the improving of the pasture so as to bring it up to the necessary standard to carry these improved sheep.

I had made several attempts to improve hill pasture by the usual methods, directly by applying artificials, and indirectly by the feeding of the sheep. Both these methods in my case were economic failures. I knew at the time that general local opinion was against me, but the opposition was mostly from men who thought that if they slagged a hillside clover would spring up, simply because they had tried it on some field or pasture that had been suffering from a shortage of phosphate, and were surprised to see a fine field of white-headed clover as the result. They did not realise that there were far bigger questions to be faced than supplying phosphate and clover seed to a sward composed of heath, sedges, mat-grass and bent. One might as well transfer a herring with a little plankton, its natural food, to one of our fresh-water lochs, and expect it to live and multiply.

For those who are not yet agreed that we have some way to go before we can improve those pastures economically, except by the ordinary methods of selective grazing and burning, I may quote from a paper published in this JOURNAL in which Capt. A. R. M'Dougal says: "As regards top dressing pastures with slag and potash my experience has been disappointing. Since 1902, I have experimented off and on with these manures separately and combined, and in no case have I been able to notice any improvement, even with very heavy dressings;"[1] or again from a paper written by Sir John Orr and Mr Allan Fraser, "Restoring the fertility of Scottish sheep grazings," published in the *Transactions of the Highland and Agricultural Society*, in which they say, regarding the indirect method: "It must, therefore, be confessed that there is a great deal of further work to be done before it can be shown that feeding is likely to increase profits materially; until that is done the commercial farmer may be interested in the results of the investigations, but cannot be expected to apply them."[2] And so in 1932 we are little further on with regard to a useful and economic method of improving hill pastures than we were in 1924, when I changed my methods of attempting to improve my Blackface flock.

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[1] *Scot. Jour. Agric.*, vol. viii., p. 147 (Apr. 1925).

[2] *Transactions*, Fifth Series, vol. 44, p. 82.

It seemed to me at that time that I was faced with a blank wall. It was useless to bring in good sheep unless I could improve the pasture to carry them. This I had tried and failed to do. The very thought of improving a hillside seemed stupendous. It then occurred to me to ask myself, seeing that I could not improve the innumerable hosts of heaths, sedges, bents and rushes, whether I could do anything with the sheep whose number was small, and whose habits and reactions were more or less known. Could they not be made to use the pasture to better advantage ? I was aware of the fundamental law, that one could not make something out of nothing, but the chemical analysis of many of the lower orders of grasses, done by Dr Voelcker and others, showed that all the necessary elements were contained in them.[1] To confirm this in practice I had found that the native Shetland sheep did not respond to first-class pastures showing clovers and foxtail in profusion, but kept in better health and condition on their native hills. In addition I had one giant ewe—a Blackface—that was never seen off the hills, and seemed to be perfectly happy among a bunch of *Luzula sylvatica.* I have often wondered how over a year's test this rush would compare with clover as to yield of food constituents or calorie value. I do not think it would be so very far below.

This threw me back two generations to Darwin's theory, "the survival of the fittest," the only economic method of improvement I could think of. I decided to let the hillside be the test, and culled those sheep that had to be artificially fed. I selected from my own ewe lambs those which I thought would best survive on the hillside, and ran out with as little hand-feeding as possible. The softer and fed sheep were marked in the spring and replaced in the autumn by selected lambs.

After three or four years of this method I was not proud of the appearance of the flock. There were many sheep with spider horns and barrel bodies, but on the other hand they could mostly feed themselves and their lambs, and costs went down. At the end of the fifth year I thought that there was a slight improvement in appearance, for there were a few nice ewes with the true Blackface show points. At the end of the sixth year when a pen of my gimmers that had never seen a feeding-box were placed second at our local show, I felt sure I was on the right lines. To-day I am quite pleased with the flock. They are a bonny even lot with the greatest asset a sheep can have, the ability to live and thrive on their natural pasture. Last winter I only fed for a few weeks twelve ewes and two ewe hoggs out of a stock of 340 ewes and 60 ewe hoggs, and the cow's milk that was required for the young lambs was negligible. I know that there is a long way to go yet, but there is a very marked improvement in the condition of the flock and the milking quality of the ewes, with an increased wool clip and lower mortality, while the percentage of eild ewes if anything is moving in the right direction. These active sheep have succeeded not only in holding their own, but in showing an all-round improvement, without the use of feeding-stuffs.

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[1] Martin J. Sutton, *Permanent and Temporary Pastures.*

During the ten years of my selective breeding I have only once procured a sire to which my flock owe quite a lot, and that was a sheep bred by a noted Scottish breeder. That tup had spent his first year on the hills of Perthshire, and had most of the required good points, except that he was a bit small and short. In fact one could almost think of him as an atavism, a "short muir" sheep with the black on the face tinged with brown. Not only could he support himself and keep in good condition, but he seemed to transmit this characteristic to his offspring. He ran his first season in 1927 and his last with me in 1932—six years. This would possibly not be considered a wise policy, but I had so much difficulty in procuring a true, useful sire that when I got one I was loth to part with him. I may mention here that I have inbred also with the native sheep to a much greater extent; and provided always that sire and dam were of the best, the results have been absolutely satisfactory.

A year's working may be shortly described before I give a few figures relating to results. The farm comprises about 1000 acres of hill, moorland and rough grazing, with about seven acres of cultivated land. Starting the year on the 1st November we find the ewes on the hillside, while the ewe lambs that are being kept for stock ewes are grazing on the aftermath where the hay has been cut, with the addition of a small piece of rough land for them to go to at night. At the end of the month they are turned out on to the lower hillside. The tups are let out about the 1st December. For the next three weeks the flock is visited by the shepherd every two or three days to see that a tup is with every heft. After four or five weeks the tups are taken in and put on the best pasture the farm can provide, while the ewe and hogg flock are carefully looked through, and all those that require to be fed are taken in, put on a ration, and marked, so that they can be disposed of in the autumn. The flock is again carefully examined in March, either early or late according to the season, and those that are in too lean condition are taken in and fed for a week or two, but these are not disposed of in the autumn unless they require a repetition of this treatment. Lambing starts about 27th April; the ewes are taken down to the lower ground, where they are kept until the lambs are about a week old. They are regularly and carefully looked through, and outstanding lambs out of good ewes are marked. The lambs are all docked in June, and the males castrated, with the exception of a dozen or so of the best which are considered likely to make useful sires.

The clipping and dipping in the beginning and end of July is practically all the summer attention the flock receives. About 14th September the old ewes and other sheep marked as bad doers are taken in and culled. The ewe lambs required to keep up the flock are picked out and the rest of the lambs sent to the sale-ring. At Aberdeen in 1934 my wedder lamb top price was 20s. 9d. and my ewe lambs sold at 18s. 6d.—not too bad considering the low price of sheep combined with the fact that I had picked out the best half of my ewe lambs to keep for stock purposes, or even when compared with the prices given in the 1935 issue of the *Transactions*, where the top price of wedder and ewe lambs are shown as 25s. 3d. and 24s. 3d. respectively.[1] To complete the circle, the ewe lambs being kept for stock ewes are put on the aftermath where we found the lambs when we started the year.

To give a complete list of figures would serve no purpose, and I shall simply give the figures relating to mortality, wool clip and percentage of eild ewes.

*Mortality.*

For the year November to October.

| | Ewes Per cent | Ewe Hoggs Per cent |
|---|---|---|
| 1924-5 | 10 | 24 |
| 1925-6 | 9 | 25 |
| 1926-7 | 9 | 12 |
| 1927-8 | 6 | 14 |
| 1928-9 | 5 | 8 |
| 1929-30 | 10[2] | 21[3] |
| 1930-1 | 6 | 14 |
| 1931-2 | 5 | 9 |
| 1932-3 | 4 | 7 |
| 1933-4 | 4 | 4 |

| | *Wool Clip.* Average Weight of Fleece lb. | oz. | *Eild Ewes.* Ewes without lambs at the end of the lambing, or unsuckled ewes Per cent |
|---|---|---|---|
| 1925 | 4 | 5 | 15 |
| 1926 | 4 | 7 | 10 |
| 1927 | 4 | 7 | 15 |
| 1928 | 4 | 9 | 12 |
| 1929 | 4 | 8 | 9 |
| 1930 | 4 | 9 | 20 |
| 1931 | 4 | 7 | 17 |
| 1932 | 4 | 9 | 14 |
| 1933 | 4 | 12 | 16 |
| 1934 | 4 | 13 | 7 |

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[1] *Transactions*, Fifth Series, vol. 47, p. 271.

[2] 4 per cent lost in the blizzard of 12th March.

[3] 12 per cent lost in the same blizzard.

With regard to the foregoing figures, it will be noticed that there is a marked improvement in death-rate, which is down by more than one half, while the weight of wool is decidedly better. A striking difference will be noticed in the mortality of the ewe lambs between 1926 and 1927. This I think was accounted for in two ways. The 1927 hoggs were vaccinated with a Braxy vaccine in 1926, and I adopted the method of turning them out on to the lower hillside at the end of November. This I think is a sound policy, as the low intown pastures are apt to be dirty and washed, while the heath, sedges and rushes grow practically all the winter, thus providing fresh nourishment for the stock. I have therefore continued vaccinating and turning the sheep out. It may be thought that by vaccinating the lambs I have departed from my method of the selection of the fittest, but it must be remembered that I have at no time been opposed to those forms of improvement which could be effected economically. Even at that early date of 1926 I was convinced of the economic value of using vaccine. The second outstanding difference in the figures is that between the numbers of the suckled ewes in the years 1933 and 1934. This is, I think, accounted for by the very fine winter and spring of 1933-34, and this explanation is borne out by the low mortality figures. It must be remembered that one or two really bad days in the lambing season with the burns in full spate may easily alter the percentage of loss among young lambs by fully four or five.

To sum up, it is very evident that an all-round improvement has been made in the flock, and this simply by selecting breeding sheep that could thrive and fatten on the pasture. It must be mentioned that there can only be a few sheep that have been bred for as long as five generations of selection, and one cannot expect too much in these few years. I am satisfied that as it is essential to run an engine on an oil for which it has been made if good results are to be obtained, so is it essential to feed a sheep on pastures to which it has become accustomed through generations of feeding.

I have so far dealt only with improvements, but there is one difference that cannot be so described. My sheep now mature more slowly as to full growth and as to breeding. This will be a very difficult barrier to surmount now that it is essential to produce a lamb suitable for the butcher, but the lambs have improved in condition and size, although they look young, and this more than sets off the failure to come early to full growth. This is one of the set-backs, and there may be others I have not yet noticed, for ten years is but a moment in the movement of evolution. These past ten years, however, have shown such major improvements that I feel certain that the survival of the fittest, aided by selection, is a sound economical way of building a first-class flock.

Most of this paper has been a statement of facts and it may be reasonable to conclude by submitting a few questions. It is this search after knowledge that helps to mark the very wide difference between the flockmaster and his flock, although one cannot help thinking that not a few flockmasters (not excluding myself) have been in the habit of walking through a gate simply because they have seen a few of their own kind preceding them.

Firstly, is it not the case that by far the largest proportion of our Scottish grazings is composed of plants belonging to the following orders, *Ericaceæ* (the heath and heather tribe), followed by *Cyperaceæ* (sedges), *Juncaceæ* (rushes), and such grasses as *Nardus* (mat-grass), *Agrostis* (bent grass), *Molinia* (purple melick grass), etc. ? Is it unreasonable to suppose that these plants, or a combination of these plants, contain all the necessary ingredients for the formation of first-class meat ?

Is it not reasonable to assume that the most economical way of turning this vegetation into meat is to feed it direct to some animal, if one can be found that can utilise it ? Can one suggest any animal more suitable to make use of these pastures than the Scottish Blackface, and is it logical to rear a sheep for generations on artificial feeding and on artificially improved pastures and then to turn it on to the hillside and expect it or its progeny to do well on these poorer pastures, perhaps more correctly described as pastures mostly composed of plants of very different construction and texture, and containing the necessary food elements mixed in very different proportions, from the plants found growing on arable or improved land ?

I must state that when I changed the method of improving my flock I had no intention of ever writing on the subject. I knew that if I was to live by farming I must be able to put on the market a mutton as cheaply produced as any belonging to my brother farmers. In addition I had to compete with my cousins in New Zealand.

When I was south in 1933 and saw some of the pastures and flocks on the lower Grampians, I asked myself whether the decreased fertility caused by the reduction of phosphate, lime, etc. through the selling of sheep was the whole explanation. Again in the summer of 1934 when I saw several flocks and pastures, from the upper valley of the Dee to Nithsdale, I still wondered. Although I tried to figure out the loss, I could not conclude that the appearance of the sheep, and the lower stock-carrying capacity, could be fully explained by the selling-off of stock. I now believe that the change is due to the reduced value of these pastures *combined* with the decreased ability of the sheep to make use of the poorer grasses. I therefore decided to write this paper, and though its value may be little, the question it deals with is of tremendous importance to Scottish flockmasters.

Finally, would it be presumption on my part if I were to suggest that the acclimatisation value of sheep stocks of which we have heard so much in later years has little to do with the climate as the word denotes, but is founded on the ability of the animal to digest and make good use of the pasture on to which it has been put ?

Statistics show that there has been a very considerable decrease in the number of sheep in the Highland districts, and I wonder whether the decreased ability of the sheep to use these grazings is not one of the prime causes. Scotland requires a sheep for its native heaths and sedges, and I believe that with skilful breeding and management the Blackface sheep is the most suitable animal to turn our Scottish moorland and mountain pastures to profit.

# SOME EFFECTS OF LIME ON RYEGRASS

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In a previous article[1] it was shown how pastures as a whole might be influenced by the application of lime—that is, how the relative numbers of the different kinds of grass were changed. As a result of the competition of one kind with another in a pasture it is difficult to judge how any one grass of itself tends to behave, so it is of interest to consider how some of these as individual units respond to lime. To this end a number of experiments have been conducted. Those relating to perennial ryegrass are dealt with here.

Nowadays a broad distinction is made between the hay type and the grazing type of ryegrass ; thus the seeds used in the experiments were from (*a*) ordinary commercial perennial ryegrass grown in Ayrshire, and (*b*) indigenous perennial ryegrass from Kent. For brevity these will be referred to as " Ayrshire " and " Kentish."

In outline the plan of the experiment was as follows. Three types of soil were selected : (1) a light sandy soil from South Ayrshire (lime requirement 3 tons, pH 4·98) ; (2) a peaty soil from West Renfrewshire (lime requirement 10 tons, pH 4·27) ; (3) a clay loam from East Renfrewshire showing practically no need for lime. Considerable quantities of these soils were brought to one centre, treated with lime and filled into large pots which were sunk to the rim in the ground to make conditions as natural as possible. The neutral loam received no lime while the sandy and peaty soils got three treatments—no lime, the lime requirement and four times the lime requirement. No fertilisers were given. In the month of May an equal number of apparently sound seeds of " Ayrshire " were sown on each of the soils and treatments, and on a second series " Kentish " seeds were sown. Seedling counts were made at repeated short intervals, growth measurements were made from time to time, and in September the numbers of tillers were counted.

The first point emerging from these experiments was confirmation of previous observations that ryegrass plants grown on acid soil generally tend to be small and rather weakly with apparently little reserve strength to survive temporary adverse conditions such as frost and drought. This weakness is not a passing phase but becomes more pronounced with time and ultimately many—probably the majority—of the plants die off.

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[1] "The Effect of Lime on Permanent Pasture." *Scot. Jour. Agric.* vol. xvii (July 1934).

*Germination.*—The germination of the seeds of the " Ayrshire " strain as officially guaranteed was 91 per cent, but it is clearly indicated from the counts of the seedlings that this figure gives little idea of the number of plants likely to establish themselves, unless the acidity of the soil has been effectively checked by adequate liming. Where this was done by applying lime at the lime requirement rate, the seedlings surviving 39 days after the sowing were 86 per 100 seeds sown on both sandy and peaty soils ; on the untreated neutral clay loam the number was 88. When, however, four times the lime requirement was applied to the sandy and peaty soils the numbers rose to 90 and 91 respectively. With the exception of the earlier counts on the clay loam these were the only cases within our experience with ryegrass or any other species where the numbers reached the official germination figure.

In the case of the plants on the acid unlimed soils the highest counts obtained were 82 on the sandy and 78 on the peaty soil at 17 days after sowing. All the plants did not survive, however, and at 39 days they were reduced to 64 and 72.

The " Kentish " strain behaved somewhat differently. The official germination here was 87 per cent, while on the sandy and peaty soils getting their lime requirement the plants per 100 seeds at 39 days numbered 80 and 74 and on the neutral clay loam 74. By increasing the lime to four times the requirement the numbers were not raised to that of the official germination, as with the " Ayrshire," but were depressed on the sandy soil and hardly influenced on the peaty soil. On the untreated acid soils the numbers were low—70 and 46 as compared with the 80 and 74 mentioned above.

Making the comparison in another way—if it be assumed that the official germination figure represents the maximum number of plants that could possibly be obtained, then the " Ayrshire " gave 70 per cent of the possible on the untreated sandy soil and 79 per cent on the peaty soil at 39 days from sowing. At the lime requirement rate it gave 94 per cent of the possible on both soils. That is, an increase of 24 per cent on the sandy soil and 15 per cent on the peaty.

With the " Kentish " the numbers on the untreated soils were 80 and 53 per cent of the possible, whereas when the soils received their lime requirements the numbers rose to 91 and 85 per cent —an increase of 11 per cent on the sandy and 32 per cent on the peaty soil.

From the periodic counts and the measurements of height of the plants, it appears that in addition to the slightly greater viability of the " Ayrshire " seeds, as indicated by the germination test, they also have the power of producing a greater number of healthy seedlings per hundred viable seeds than have those of the " Kentish " strain. Further, while the " Ayrshire " responded much better to the one-lime requirement treatment on the sandy soil than the "Kentish" (24 per cent against 11 per cent) and the "Kentish" better than the " Ayrshire " on the peaty soil (32 per cent against 15 per cent), the response to the four-lime requirement treatment was entirely to the advantage of the " Ayrshire." Thus, on these bases of reckoning, the "Ayrshire" in its early stages seems on the whole to be decidedly more responsive to the influence of lime, or conversely to have its potentiality for the production of a high percentage of healthy young plants more repressed by severe soil acidity, than the " Kentish " strain.

The fact of fewer seedlings being found, after five or six weeks from sowing the seed, on untreated acid soil than where lime was applied, was apparently due partly to the failure of the seeds to germinate at all—or at least to produce a shoot long enough to reach the soil surface—and partly to the seedlings dying between three and five weeks from the time of sowing. This mortality among the seedlings was the more important cause of the small number of healthy maturing plants as compared with the number of seeds sown. The dying of the seedlings was not entirely confined to the untreated soils, but was much more prevalent there than where lime had been given.

On the peaty soil both types experienced difficulty in emerging from the seedling stage and becoming established plants. It took the " Ayrshire " fully six weeks from the first appearance of the seedlings above ground to overcome this period of arrested growth and proceed normally. On the other hand the tallest plant which the " Kentish " could produce after three months was only 3½ inches high and the majority were considerably smaller. In addition to having retarded growth, the condition of the acid peaty soil seemed to have delayed germination to some extent, though the number of new plants arising from seeds activated later was just sufficient to replace casualities among the previously existing seedlings.

*Tillering.*—Tillering was commenced by both types between five and six weeks from sowing the seed. It began first on the sandy soil with the four-lime requirement treatment, then on the same soil with the one-lime requirement and on the neutral clay loam. On the untreated sand the " Ayrshire " was earlier than the " Kentish." It was some time later before there was any tillering on the peaty soil and there, as on the sand, it was most profuse under the high rate of liming. In the early autumn when actual counts of the tillers were made, it was noticeable that for the most part where tillering had begun earliest it was most abundant. In all cases the four-lime requirement treatment gave the greatest average number of tillers, except in the case of the "Kentish" on the sandy soil, where the number was almost the same as at the one-lime requirement rate; and in all cases except the "Ayrshire" on the peaty soil there was a large increase on the one-lime requirement over the untreated. Indeed, up to the time of counting (September), the "Kentish" had failed to produce any tillers on the untreated peaty soil. The indications are therefore, so far as tillering is concerned, that on acid sandy soil the "Ayrshire" type responds much better to additions of lime than the "Kentish," while on peaty soil the reverse is the case, but while the "Kentish" gives little additional response to raising the lime content of either sandy or peaty soil much beyond the lime requirement, the "Ayrshire" does give a response. The latter apparently requires a heavy dressing of lime on peaty soil to induce increased tillering.

*Total Growth.*—The number of tillers alone is not always a true indication of the amount of growth that has been made, but if tillers and average leaf length be taken together, a good idea of the relative amount of total growth can be obtained. If the average number of tillers be multiplied by the average number of inches of leaf length and the product divided by 100—to give easily handled figures and eliminate small differences—a figure which we may call an Index of Growth is obtained for each case. A comparison of these Indexes in the table below enables the grasses on the different soils and treatments to be placed in the same relative positions as would be done by actual observation.

*Indexes of Growth of Perennial Ryegrasses*

| Soil | Treatment | "Ayrshire" | "Kentish" |
|---|---|---|---|
| Sandy . . . | No lime | 1·0 | 3·3 |
| ,, . . . | 1 lime requirement | 5·8 | 4·1 |
| ,, . . . | 4 ,, ,, | 5·8 | 4·8 |
| Peaty . . . | No lime | 1·7 | . . |
| ,, . . . | 1 lime requirement | 1·6 | 2·0 |
| ,, . . . | 4 ,, ,, | 2·9 | 3·2 |
| Clay Loam . . | No lime | 2·4 | 2·9 |

It will be seen from the above figures that the position from the aspect of total growth is not quite the same as when considering tillers only. The "Ayrshire" responded more to treatment on the sandy soil than the "Kentish"; the "Kentish" more on the peaty soil than the "Ayrshire"—since the "Kentish" gave no tillering on the untreated soil. This is in agreement with the tiller counts alone. But whereas the number of tillers of the "Kentish" did not increase appreciably with the further addition of lime and that of the "Ayrshire" did, the increased leaf length of the "Kentish" tended to increase the growth as a whole on the sandy soil. The additional growth, however, was not great, the increase in the Index being only 0·7. On the peaty soil the increase in the Index was practically the same for both—1·3 for the "Ayrshire" and 1·2 for the "Kentish."

It is noteworthy that on the neutral clay loam the number of tillers of both grasses fell between those on the peaty and sandy soils receiving the one-lime requirement, being higher than on the former and lower than on the latter. The amounts of growth occupied the same relative positions.

*Rooting*.—During the summer the opportunity was taken to observe whether the treatments had in any way influenced the root development. It had done so in marked degree. At first it was noticed that in an attempt to pull up individual plants those on untreated acid soils came away readily; those on the soils getting the one-lime requirement were pulled with difficulty and with much breaking of the roots; those where the heavy liming had been given could not be dislodged by pulling. When plants were carefully dug up it was found that the roots on the untreated soil were comparatively shallow with hardly any ramification; at the lime requirement they were deeper and more branched, while at the heavy liming they had penetrated still more deeply and had spread out in a wide network of fibrous rootlets.

*Conclusions*.—While fully realising that under different conditions results would not be obtained exactly as outlined above, from the experiment as conducted the following are the findings, which are sufficient to indicate how widely even strains of the same grass may differ in their responses to practically similar conditions.

(1) The number of surviving seedlings is influenced by the lime status of the soil. This number is usually increased by adding lime to acid soil.

(2) The ordinary hay type of perennial ryegrass, while developing 70 to 80 seedlings per 100 viable seeds on light acid soils, may give over 90 when the soil receives its lime requirement, and almost every viable seed may develop a plant when heavy liming is given.

(3) The indigenous "Kentish" perennial ryegrass develops 50 to 80 seedlings per 100 viable seeds on light acid soil and 80 to 90 at the lime requirement rate, but the numbers are not raised with very heavy liming.

(4) Both types on light acid soils tend to tiller earlier and produce a greater number of tillers when heavy liming is given.

(5) Apparently in total growth the ordinary commercial type responds more than the "Kentish" to additions of lime to acid sandy soil; on peaty soil the position is reversed.

(6) Both types produce more total growth on neutral clay loam than on acid peaty soil receiving its lime requirement, but less growth with fewer tillers than on acid sandy soil similarly treated.

# WHEAT PRICES AND THE ACREAGE OF WHEAT IN GREAT BRITAIN

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UNTIL very recently, market value or price has been regarded as the best guide for production. Increasing demand or inadequate supplies led to a rise in value which was relied upon, under a system of free enterprise, to increase the supply; a decreased demand or too great a supply, by causing a fall in value, induced productive efforts to be turned in other directions. Farmers were free to adjust their output of the various products according to the relationships of the prices received, costs of production, and the alternative opportunities open to them.

The price mechanism is not the only means of adjusting supply to demand, or controlling production. In Russia, for instance, it has been superseded by the direct allocation of the various resources —land, labour and capital—to those uses which the central authority regards as most necessary.

Even in many countries where the price system is ostensibly at work, methods have been devised to isolate production from the effects of price. In the United States, under the Agricultural Administration Act, higher prices for many commodities are prevented from increasing output by being made dependent upon restriction of production. Lower prices are no longer left to effect a reduction of output.

In Great Britain, under the Agricultural Marketing Acts, the production of hops and potatoes is no longer left to be conditioned by price alone. The acreage of sugar beet, also, is no longer left to the free play of the price factor. In these three instances, the objective has been to limit or curtail the expansion of output.

On the other hand, the expansion of the wheat acreage has been left to the price system to accomplish and the price paid to the farmer has been maintained as the factor to control the acreage laid down to wheat. While the price system is generally regarded as acting too slowly in accomplishing a decrease in production, experience, elsewhere as well as in Great Britain, shows that it does work successfully in achieving increased output.

A study of the relationship between wheat prices and the acreage of wheat in this country indicates not only that price has played a marked part in controlling the expansion and reduction of the wheat acreage, but also that the time-lag in the effect of price on production has been materially shorter in post-war than in pre-war years.

**1904-1914.**—In the pre-war period, the area of wheat declined from 1,756,000 acres in 1906 to 1,625,000 acres in 1907; increased, with a slight check in 1910, to 1,926,000 acres in 1912;

declined in 1913 to 1,756,000 acres, and rose again to 1,868,000 acres in 1914.

These changes were due to alterations in the price of wheat, or, more exactly, in the price of wheat relatively to the prices of the alternative products which farmers could grow. An increase in returns for wheat, relative to returns from alternative crops or products, tended to cause an increase in the wheat acreage, while a relative decrease in wheat returns caused a decline in the wheat area.

In this period the acreage of wheat harvested in one year was related to the price of wheat, not in the preceding autumn when the wheat was planted, but in the September to November before. If wheat was dear relatively to other products in these months, the farmer decided so to adjust his rotation as to plant more wheat the next autumn, to be harvested nearly two years later ; if wheat was cheap relative to other products, the wheat acreage two years later declined.

In some of the important wheat-growing parts of the country the strongest competitor to wheat is barley, a rise in barley prices causing an increase in the barley acreage at the expense of wheat and *vice versa.* In other parts the increases or decreases in wheat acreage come out of fallow, potatoes, oats, grassland and other forage crops, eventually marketed as live-stock products. These latter shifts are more in the nature of long-term changes, whereas shifts to sale crops such as barley are more easily and rapidly achieved. Taking the country as a whole, there was a closer relationship between the wheat acreage and the price of wheat relative to all products than between the wheat acreage and the price of wheat relative to barley alone.

Wheat prices have been taken, therefore, in relation primarily to the prices of other competitive products, weighted according to their relative importance,[1] and secondly, to barley alone. This computation gives the " purchasing power " of wheat in relation to other agricultural products and to barley.[2] For example, using 1911-13 prices as a base, the September-November wheat price index in 1910 was 95, that of other agricultural products 95, and that of barley 81. Wheat prices were therefore, compared with 1911-13, on the same level as most agricultural prices though high-priced relative to barley. In terms of barley, the "purchasing power" of wheat may be said to have been 17 per cent above parity, *i.e.* 117 ($\frac{95}{81} \times 100$), while in terms of all products it was 100 ($\frac{95}{95} \times 100$). The accompanying table gives the purchasing power of wheat in terms of barley and of all products, and the wheat acreage in Great Britain, from 1904 to 1914.

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[1] Barley (6), oats (2), fat cattle (25), fat sheep (13), pigs (13), eggs (2), milk (21), butter (3), cheese (1), potatoes (6).

[2] Actual wheat prices do not determine the wheat acreage, since they are influenced by changes in the value of money, which affect all prices. The effect of changes in the value of money can be partially eliminated by using the " purchasing power " of wheat, which measures the relative height of the price of wheat compared with the prices of other agricultural products. This is the causal factor of the changes in wheat acreage. Thus, if wheat prices rose by 25 per cent, while other agricultural prices remained unchanged, the " purchasing power " of wheat would also have increased 25 per cent. If, however, not only wheat prices but also the average of other agricultural prices rose by 25 per cent, then the " purchasing power " of wheat would remain unchanged, and the attractiveness to the farmer of sowing wheat compared with producing other agricultural products would not have altered.

The price of wheat in terms of all agricultural products fell from 107 in 1904 to 90 in 1906, rose to 114 in 1907, fluctuated for the next few years, and declined to 102 in 1912.

The relationship prevailing between the wheat acreage and the purchasing power of wheat over other agricultural commodities in general is brought out in Fig. 1(i). Each dot represents the purchasing power of wheat in one autumn (given on the horizontal scale of the diagram) and the acreage of wheat in the next year but one (shown on the vertical scale). Thus, in September to November 1906 the purchasing power of wheat in terms of other agricultural products was 90, while the acreage of wheat harvested in 1908 was 1,627,000 acres. Similarly, in 1909 purchasing power was 114, and the wheat area in 1911 was 1,906,000 acres.

It is clear from the diagram that the higher the purchasing power, the greater, in general, was the acreage harvested two years later. Thus the lowest purchasing powers of wheat, 1905 and 1906, were followed by the lowest wheat acreages, 1907 and 1908; similarly higher purchasing powers were followed by higher wheat acreages. The straight line drawn through the dots indicates an average relationship prevailing between the purchasing power of wheat in terms of other agricultural products and the acreage of the crop two years later.

PURCHASING POWER AND ACREAGE OF WHEAT IN GREAT BRITAIN, 1904-14

| Year | Price of wheat per cwt. Sept.-Nov. | Price of barley per cwt. Sept.-Nov. | Index numbers 1911-13=100 | | | Purchasing power of wheat in terms of | | Acreage of wheat 000 acres |
|---|---|---|---|---|---|---|---|---|
| | | | Wheat | Barley | All products[1] | Barley | All products | |
| | s. d. | s. d. | | | | | | |
| 1904 . . | 6 8 | 5 7 | 94 | 83 | 88 | 113 | 107 | .. |
| 1905 . . | 6 1 | 5 5 | 85 | 81 | 90 | 105 | 94 | .. |
| 1906 . . | 5 10 | 5 6 | 82 | 81 | 91 | 101 | 90 | 1,756 |
| 1907 . . | 7 6 | 5 10 | 105 | 86 | 92 | 122 | 114 | 1,625 |
| 1908 . . | 6 11 | 6 0 | 97 | 89 | 88 | 109 | 110 | 1,627 |
| 1909 . . | 7 4 | 6 0 | 103 | 89 | 90 | 116 | 114 | 1,823 |
| 1910 . . | 6 9 | 5 6 | 95 | 81 | 95 | 117 | 100 | 1,809 |
| 1911 . . | 7 3 | 6 11 | 102 | 103 | 97 | 99 | 105 | 1,906 |
| 1912 . . | 7 3 | 6 9 | 102 | 100 | 100 | 102 | 102 | 1,926 |
| 1913 . . | .. | .. | .. | .. | .. | .. | .. | 1,756 |
| 1914 . . | .. | .. | .. | .. | .. | .. | .. | 1,868 |

This line or "curve" indicates that, in the absence of disturbing causes, an index number of wheat prices compared with general agricultural prices of 90 in one autumn would lead to a wheat acreage of 1,670,000 acres harvested in the next year but one, while an index of 110 would result in an acreage of about 1,840,000 acres. Every rise of 10 points in the purchasing power of wheat tended to increase the wheat acreage by about 98,000 acres.

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[1] See footnote (1), p. 355.

While there is a fairly close general relationship between the autumn purchasing power of wheat and the area of the crop in the next year but one, as indicated by the line in Fig. 1(i), there are divergencies of the individual observations from the fitted line, indicating that factors other than the price of wheat and the general level of other agricultural prices have affected the wheat acreage. The largest divergency occurred in the relationship between the wheat acreage of 1912 and the purchasing power of wheat in 1910. The area in that year was 170,000 acres greater than would have been expected from the purchasing power of wheat in the autumn of 1910. This discrepancy can be explained by the low price of barley in the autumn of 1910. In that year barley prices were lower, compared with other agricultural prices, than in any other of the pre-war years considered. Thus farmers were encouraged to substitute wheat for barley when they planted a year later, and the wheat acreage of 1912 was much higher than would otherwise have been expected.[1]

With the exception of this year, the price of wheat in terms of other agricultural prices provides a fair explanation of the movement of the wheat acreage in pre-war years.

**1924-1934.**—During the war the normal relationship between wheat prices and acreage was superseded by special measures; by 1925, however, the effect of these measures had disappeared to a great extent. In this year, the wheat acreage of Great Britain—1,548,000 acres—was substantially below the pre-war average. By 1927 it had risen to 1,703,000 acres; it then declined rapidly, with the exception of a slight rise in 1930, to 1,247,000 acres in 1931. During the next three years it rose again until in 1934 it reached 1,857,000 acres, an amount slightly above the average of the years 1906-14.

The movement of acreage during this post-war period was again closely associated with the price of wheat relatively to the prices of other agricultural products in the preceding autumn. Instead of prices in one autumn affecting the acreage planted in the next year and consequently the acreage harvested in the next year but one, as they did in pre-war years, they now affected the acreage planted in the same autumn and harvested in the immediately succeeding year. This shortening in the time-lag is reasonable: firstly, the greater latitude in leases and cropping makes it easier for the farmer to change from one line to another; secondly, the greater instability in prices during the post-war period has resulted in more rapid reaction to price changes on the part of the farmer; and thirdly, threshing may now be undertaken earlier in the season than formerly and the realised price for the crop is now obtained earlier in the season, whereas previously the returns from winter or spring threshing were not obtained in time to influence the next crop.

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[1] In calculating the regressive equation the 1910 purchasing power and 1912 acreage have been omitted.

### PURCHASING POWER AND ACREAGE OF WHEAT IN GREAT BRITAIN, 1924-34

| Year | Price of wheat per cwt. Sept.-Nov. | | Price of barley per cwt. Sept.-Nov. | | Index numbers (1911-13=100) | | | Purchasing power of wheat in terms of | | Acreage of wheat 000 acres |
|---|---|---|---|---|---|---|---|---|---|---|
| | s. | d. | s. | d. | Wheat | Barley | All products[1] | Barley | All products | |
| 1924 . . | 12 | 5 | 16 | 10 | 166 | 200 | 171 | 83 | 97 | .. |
| 1925 . . | 11 | 0 | 12 | 7 | 147 | 149 | 161 | 99 | 91 | 1,548 |
| 1926 . . | 11 | 8 | 12 | 0 | 156 | 142 | 156 | 110 | 100 | 1,646 |
| 1927 . . | 10 | 7 | 13 | 2 | 141 | 156 | 142 | 90 | 99 | 1,703 |
| 1928 . . | 9 | 7 | 11 | 4 | 127 | 134 | 146 | 95 | 87 | 1,454 |
| 1929 . . | 9 | 6 | 10 | 1 | 127 | 120 | 148 | 106 | 86 | 1,381 |
| 1930 . . | 6 | 11 | 9 | 2 | 93 | 109 | 141 | 85 | 66 | 1,400 |
| 1931 . . | 5 | 9 | 9 | 4 | 76 | 110 | 122 | 69 | 62 | 1,247 |
| 1932 . . | 9 | 9¾[2] | 8 | 0 | 131 | 95 | 110 | 138 | 119 | 1,340 |
| 1933 . . | 9 | 6[2] | 10 | 1 | 127 | 120 | 116 | 106 | 109 | 1,739 |
| 1934 . . | 9 | 2½[2] | 9 | 7 | 123 | 114 | 122 | 108 | 101 | 1,857 |

The price of wheat relative to the prices of other agricultural products fell from 100 in 1926 to so low as 62 in 1931, and then recovered under the Wheat Act to 119 in 1932.

The relationship between this purchasing power and subsequent wheat acreage in Great Britain is shown in Fig 1 (ii). The dots in this case represent the purchasing power prevailing in one autumn and the wheat acreage harvested in the next year. Thus, in September to November 1924, the purchasing power of wheat prices in terms of other agricultural products was 97, while the acreage of wheat harvested in 1925 was 1,548,000 acres. Similarly the 1932 purchasing power was 119 and the wheat area in 1933 was 1,739,000 acres. It is clear that high purchasing power led, on the whole, to high acreage, and *vice versa*. Thus the lowest purchasing powers in 1930 and 1931 were followed by the lowest acreages in 1931 and 1932.

The line, or curve, running between the dots indicates the average relationship which prevailed between purchasing power and subsequent acreage from 1924 to 1933. It shows that, in the absence of disturbing causes, a purchasing power of wheat of 70 in one autumn would be followed by a wheat area of about 1,320,000 acres, while a purchasing power of 110 would be followed by one of

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[1] See footnote (1), p. 355.

[2] Enhanced price under the Wheat Act.

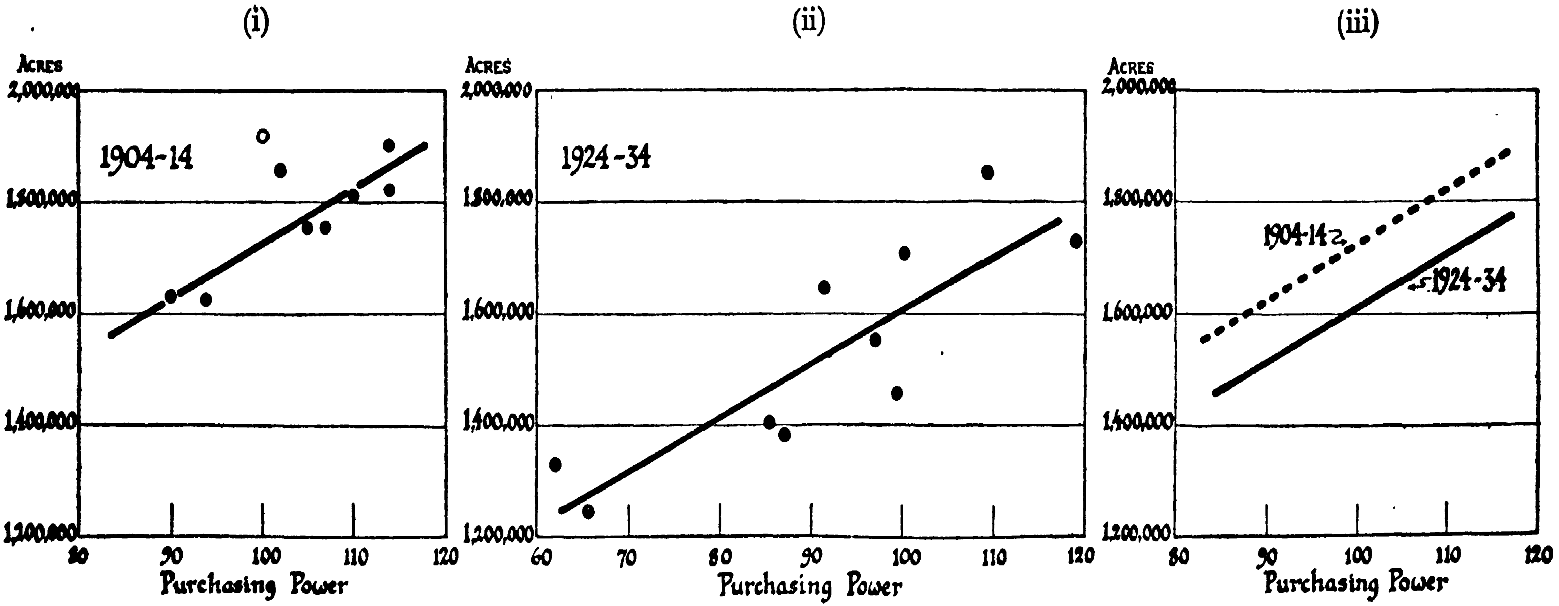

Fig. 1.—The relationship between the purchasing power of wheat, in September-November, in terms of other agricultural products and the acreage of wheat in Great Britain (i) in the next year but one, 1904-1914; (ii) in the following year, 1924-1934; and (iii) in both periods.

1,710,000 acres. Every rise of 10 points in the index of purchasing power raised the wheat acreage by about 95,000 acres.

In the autumn of 1934 the wheat price, including the deficiency payment under the Wheat Act, was 9s. 2½d. per cwt., an index of 123; the index of other agricultural prices was 122, giving a purchasing power of wheat in terms of other agricultural commodities of 101. Provided that the relationship between price and acreage has not undergone any fundamental change, the line indicates that, with such an index number, a wheat acreage of at least 1,620,000 acres might have been expected in 1935.[1]

In the absence of quota payments, the farmers' price would have been 5s. per cwt. in the autumn of 1934, giving an index number of wheat prices of 67 and a purchasing power in terms of other agricultural commodities of 55. Since no purchasing power was recorded so low as this, it is impossible to state on the basis of past experience what acreage of wheat might be expected, but it is probable that the wheat area in 1935 would not have exceeded 1,200,000 acres.

While the general relationship between the purchasing power of wheat in terms of other agricultural commodities and the subsequent wheat acreage is even more convincing in post-war than in pre-war years, the divergencies of individual observations from the curve again indicate the presence of other factors affecting wheat acreage.

For example, in 1925, the wheat acreage was 35,000 acres less than might have been expected from the level of wheat prices compared with other agricultural prices in the preceding autumn. In 1925, 1926, 1932 and 1934 a greater acreage was recorded than the relationship line indicated, while from 1928 to 1930 and in 1933 the actual acreage was lower than would have been expected.

These divergencies, which are charted in Fig. 2, can be explained, for the most part, until 1932, by the prices of barley relative to the prices of other agricultural products.[2] During these years when the price of barley was relatively high in one autumn, the wheat acreage in the next year was lower than would have been expected from the level of wheat prices compared with all other agricultural prices. When barley was relatively high in price, some farmers planted barley in place of wheat. Thus a higher wheat acreage would be expected for the same relative price of wheat and other agricultural prices when barley prices in the preceding year were low.

This relationship to barley prices does not hold after 1931 when various special factors entered into consideration. The 1932 wheat acreage was slightly higher than expected from the relative prices of wheat and barley in 1931, possibly owing to the farmers' hope—subsequently fulfilled—of assistance from the Government.

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[1] The actual area of wheat in Great Britain in 1935, according to the Preliminary Statements issued by the Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland, was 1,872,000 acres. This figure is subject to revision.

[2] The index number of other agricultural prices is the same as that described in footnote 1, p. 355, except that barley prices are excluded, and wheat prices, including the quota payment, are included and given a weight of 8.

The 1933 acreage was lower than the purchasing power of wheat warranted. The rise in price resulting from the Wheat Act was very sudden, the purchasing power of wheat in terms of other products rising from 62 in the autumn of 1931 to 119 in the autumn of 1932. The wheat acreage responded immediately and rose to 1,660,000 acres for the subsequent crop, though this was not as high as might have been expected, owing possibly to the suddenness of the jump in price; part of the reaction to the 1932 price was delayed until the next year, when the area under wheat rose to 1,758,000 acres.

The 1934 acreage was higher than might have been expected and it is possible that the right-hand end of the curve (Fig. 1 (ii)) is not on a sufficiently high level.

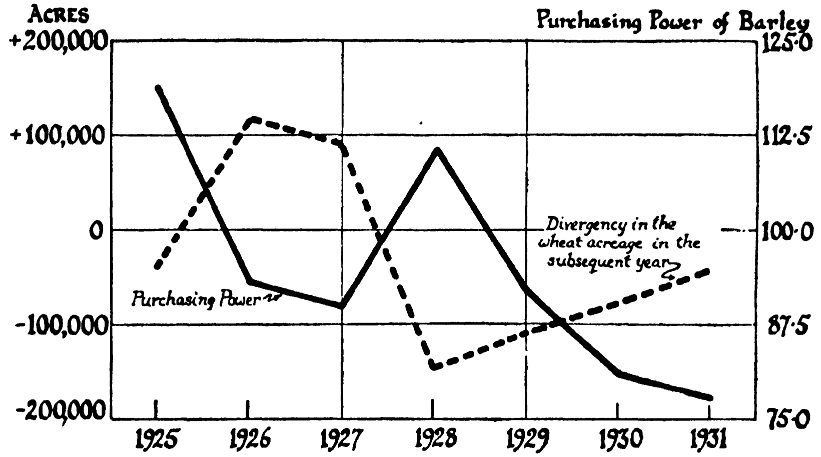

FIG. 2.—The purchasing power of barley in terms of other agricultural products and the divergencies of the acreage of wheat from the "expected" area in the following year, 1925-1931.

This end of the curve could be raised in two ways. It could be made to rise more steeply after the purchasing power of 100 has been reached, so that, for purchasing powers of wheat greater than 100, any increase of purchasing power involves a progressively greater and greater expansion of acreage. This would imply that, once the wheat acreage has increased beyond about 1,600,000 acres, it becomes easier and easier to divert land from other uses to wheat growing. This assumption does not appear probable.

A more satisfactory explanation lies in the possibility that the quantitative relationship based on the experience of the period from 1924 until 1932 has changed; the whole line may have shifted vertically so that a given purchasing power of wheat now results in a higher wheat acreage than it did from 1924 to 1932.[1]

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[1] The high wheat acreage achieved in 1935, in spite of a fall in the purchasing power of wheat in 1934, supports this contention.

This possibility implies that some change in production conditions has occurred which has generally made it easier and cheaper to grow wheat, so that, for any given wheat price relative to other agricultural prices, a larger wheat acreage would be expected now than a few years ago. This assumption is probably correct. The degree of mechanisation of cereal growing has increased substantially in recent years, so that it is now possible for many farmers to sow and harvest, in the necessary periods, a larger volume of wheat than before. Reduction in price risks may also be considered as a reduction in production costs.

It is therefore probable that, at the present time, the line drawn in Fig. 1 (ii) is lower than the line which would show the actual present relationship. How much the line may have shifted cannot be measured more accurately until more data are available under the new conditions.

The theory that the position of the line has changed is borne out by a comparison of the pre-war and post-war lines (Fig. 1 (iii)). The pre-war line indicates that, on the average, the same purchasing power of wheat led to a wheat area from 120,000 to 150,000 acres greater than in post-war years. As, in fact, wheat prices had risen less than other agricultural prices between the pre-war and post-war periods, the purchasing power of wheat, until the passage of the Wheat Act, was generally lower in post-war than in pre-war years, and the wheat acreage substantially lower.

This relationship of the two lines indicates that the costs of producing wheat, compared with the costs of producing alternative commodities available to the farmer, were lower before the war than after. This was almost certainly true. It is believed that during the post-war years, at any rate until 1932, when the prices of live stock and other products gave better returns than wheat, greater technical progress was made in the production of these than of wheat; the pre-war parity of wheat prices to other products was therefore disturbed by the change in relative costs of production. It may well be that the restoration of wheat-purchasing power more approximately to its pre-war position, and the relatively rapid recent progress in wheat production methods, will bring back the pre-war parity and relationship.

If this is so, any change in the price of agricultural commodities or in the price of wheat, either of which would affect the purchasing power of wheat, would probably alter the wheat acreage more in conformity with the pre-war line than with the post-war line, though high or low prices for barley relative to other prices might again cause the wheat acreage to diverge from the line in any one year.

It was the intention of Parliament, in the passing of the Wheat Act, to increase the United Kingdom wheat area to 1,800,000 acres,[1] which is slightly below the pre-war area. This was achieved by means of a payment which raised the purchasing power of wheat, first to 119 and then subsequently into parity with other products.

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[1] Including Northern Ireland, which now has a wheat area of 8,000 to 9,000 acres.

If the above analysis is correct, it appears probable that this acreage can be maintained if the purchasing power of wheat in terms of other agricultural products is held at between 100 and 110, *i.e.* about 9s. per cwt. at the present level of prices. If there is a further progress in wheat production methods as compared with other lines of production, such as has occurred since 1932, it is possible that the same purchasing power might support an even higher wheat acreage ; otherwise there does not appear to be much basis for expecting the wheat acreage to increase much further as a result of the Wheat Act.

The following note on the statistical method used is added for the information of readers interested in the technical aspect of the subject :—

These regression equations show the amount of change in the acreage of wheat that might be expected from a change in the purchasing power of wheat for the pre-war and post-war periods respectively :—

(1) 1904-14 ; $X_1 = 749{,}500 + 9{,}778X_2$, where $X_2$ is the September-November purchasing power of wheat in terms of other agricultural products in the y year (1911-13 = 100), and $X_1$ is the acreage of wheat in Great Britain in the y + 2 year (1910 purchasing power and 1912 acreage omitted).

(2) 1924-34 ; $X_1 = 658{,}400 + 9{,}532X_2$, where $X_2$ is the September-November purchasing power of wheat in terms of other agricultural products in the y year (1911-13 = 100) and $X_1$ is the acreage of wheat in Great Britain in the y + 1 year.

These equations indicate that a rise or fall of ten points in the purchasing power of wheat raised or lowered the acreage of the next wheat crop but one in pre-war years by 97,780 acres ; while in post-war years the same change altered the acreage of the next wheat crop by 95,320 acres.

## Milking-Machines in Scotland

THE following article is contributed by Messrs Andrew C. M'Candlish and J. P. Struthers, Milk Production Department, the West of Scotland Agricultural College.

A survey of the milking-machines in the milk-recorded herds of Scotland was conducted by M'Candlish and Cochrane [1] in 1929. Since that time there has been some discussion as to whether or not machine milking was on the increase, so, with a view to obtaining information on this point, another survey was carried out in 1934.

[1] West of Scotland Agric. Coll., Bull. 121 (1930).

In these surveys the details for each herd were obtained by the recorders of the Scottish Milk Records Association. To this Association, Mr W. Stevenson the Superintendent, and the recorders, we wish to express our thanks for their co-operation.

For convenience in the presentation of the data Scotland has been divided into a number of areas which vary considerably in size. Within any given area, however, the system of dairy farming employed is comparatively uniform.

The divisions used are: (1) the south-west, including the counties of Dumfries, Kirkcudbright and Wigtown; (2) Ayrshire; (3) the Clyde Valley, containing Lanark, Dunbarton, Renfrew and Bute; (4) Argyllshire, which really means the Campbeltown district; (5) the south-east, which includes the Lothians and the three south-eastern border counties; and (6) the north, which includes the remainder of Scotland.

*Spread of Milk-recording.*—From 1929 to 1934 there has been an increase in milk-recording in Scotland. The number of herds has risen from 708 to 742, while the total number of milk-recorded cows has gone up from 29,654 to 34,243, or an increase of 5 per cent in herds and 16 per cent in cows recorded.

The figures given for the numbers of herds and cows need not necessarily coincide with those given in the annual reports of the Scottish Milk Records Association. This is due to the fact that the surveys were made by the recorders during single rounds, while the Association reports cover complete years.

The recorded herds and cows for the various areas are given in Table I. With this is included the percentage variation from 1929 to 1934.

TABLE I

*Recorded Herds and Cows for* 1929 and 1934

| District | Herds 1929 No. | Herds 1934 No. | Cows 1929 No. | Cows 1934 No. | Variations Herds Per cent | Variations Cows Per cent |
|---|---|---|---|---|---|---|
| South-west | 250 | 238 | 14,493 | 14,284 | –5 | –1 |
| Ayrshire | 156 | 178 | 5,632 | 7,609 | 14 | 33 |
| Clyde Valley | 127 | 141 | 3,904 | 5,353 | 13 | 37 |
| Argyllshire | 24 | 12 | 1,051 | 515 | –50 | –51 |
| South-east | 26 | 27 | 940 | 1,263 | 4 | 34 |
| North | 125 | 146 | 3,634 | 5,219 | 17 | 44 |
| Total | 708 | 742 | 29,654 | 34,243 | 5 | 16 |

The changes in milk-recording during the period under review have not been uniform from district to district. Argyllshire shows the greatest change with a decrease of 50 per cent in herds and 51 per cent in cows recorded. This has probably been brought about by the difficulties of marketing dairy products from outlying districts in recent years.

The only other district to show a decrease in recorded herds and cows is the south-west, with a decrease of 5 per cent in herds and 1 per cent in cows. One county in this group, Kirkcudbright, showed an increase in the herds and cows recorded.

The largest increase of all was 17 per cent in herds and 44 per cent in cows in the north, while the Clyde Valley with 13 per cent more herds and 37 per cent more cows recorded in 1934 than in 1929 was followed closely by Ayrshire with 14 per cent more herds and 33 per cent more cows recorded. The other districts were in an intermediate position.

There has been an increase in milk recording in Scotland as a whole. The increase is largely in districts where the decrease of arable farming has led to an increase in dairying, and in the dairying districts around Glasgow.

*Machine Milking.*—Now that the variations in the recorded herds have been pointed out, consideration can be given to the variations in machine milking among recorded herds. Details are given in Tables II and III.

TABLE II

*Machine-milked Herds and Cows*

| District | Herds 1929 No. | Herds 1934 No. | Cows 1929 No. | Cows 1934 No. |
|---|---|---|---|---|
| South-west | 71 | 62 | 4,861 | 4,106 |
| Ayrshire | 7 | 12 | 399 | 629 |
| Clyde Valley | 2 | 12 | 98 | 451 |
| Argyllshire | 3 | 3 | 157 | 182 |
| South-east | 5 | 13 | 287 | 796 |
| North | 6 | 27 | 281 | 1,224 |
| Total | 94 | 129 | 6,083 | 7,388 |

TABLE III

*Percentage of Recorded Herds and Cows Machine-milked*

| District | Herds 1929 Per cent | Herds 1934 Per cent | Cows 1929 Per cent | Cows 1934 Per cent |
|---|---|---|---|---|
| South-west | 28 | 26 | 34 | 29 |
| Ayrshire | 4 | 7 | 7 | 8 |
| Clyde Valley | 2 | 9 | 3 | 8 |
| Argyllshire | 12 | 25 | 15 | 35 |
| South-east | 19 | 48 | 31 | 63 |
| North | 5 | 18 | 8 | 23 |
| Average | 13 | 17 | 21 | 22 |

With two exceptions, as shown in Table II, every district shows an increase in the number of recorded herds that are machine-milked. Argyllshire shows a constant number, while the south-west shows a decrease, though Kirkcudbright has an increase. In every district except the south-west there is an increase in the number of recorded cows that are machine-milked.

When the herds and cows machine-milked are expressed as percentages of the totals recorded, as in Table III, it is found that the machine-milked herds have risen from 13 per cent in 1929 to 17 per cent in 1934, while the machine-milked cows have risen from 21 to 22 per cent. There is an increase in the percentage of both herds and cows machine-milked in all districts except the south-west, which shows a decrease. Within the south-west, Kirkcudbright again shows an increase.

*Summary.*—During the years 1929 to 1934 there has been an increase in the percentage of milk-recorded herds in Scotland, as well as in the absolute number, which are machine-milked. The increase may not seem large, but as an additional 1,305 milk-recorded cows are being machine-milked it may be of some significance.

## Notes from Agricultural Colleges

### *Craibstone*

*Grasses and Clovers*, 1935.—The advantage of sowing a suitable blend of Red clover, especially of the Late-flowering type, in a grass seed mixture was well demonstrated this year. Previous trials with Late-flowering Red clovers had shown that while in many seasons Montgomery was generally superior to all others, in other seasons English or Swedish was best. This year English samples were distinctly best. The reason appears to be that the latest Late-flowering Reds were much slower in starting to grow in spring owing to cold weather in May and the first half of June. This late start allowed the grasses in these plots to get well ahead so that they competed more adversely against the clover. The later the clover was in starting growth the greater was the competition. Thus Norwegian Late-flowering, which is the very latest, was slowest in developing and consequently was least prominent in the hay, while Swedish, which is the next latest, was not nearly so prominent as it is in most seasons.

The following table gives the results from typical plots of the most important kinds.

| | Per acre<br>Clover<br>cwt. | <br>Grass<br>cwt. | <br>Total<br>cwt. |
|---|---|---|---|
| *Late-flowering*— | | | |
| American Mammoth . | 21·4 | 34·7 | 56·1 |
| Essex . . . . | 42·4 | 24·4 | 67·8 |
| Montgomery . . . | 29·7 | 29·7 | 59·4 |
| Suffolk . . . . | 41·4 | 23·5 | 64·9 |
| Swedish . . . | 26·6 | 30·4 | 57·0 |

| | Clover cwt. | Per acre Grass cwt. | Total cwt. |
|---|---|---|---|
| *Broad-leaved—* | | | |
| Canadian | 11·9 | 42·7 | 54·6 |
| Chilian | 13·3 | 45·5 | 58·8 |
| English | 28·5 | 36·4 | 64·9 |
| Gloria | 4·6 | 45·2 | 49·8 |
| New Zealand | 26·7 | 36·9 | 63·6 |
| Polish | 5·7 | 44·3 | 51·0 |

These results show that the English Late-flowering kinds, as represented by Essex and Suffolk samples, were much superior to those from other sources.

It is interesting to note that several of the samples from Essex were registered seed, a Red Clover Growers' Association similar to those in operation in Montgomery and Cornwall having been established in that county. It is understood that other counties are considering the forming of associations.

These associations are to be commended, and it is hoped that seedsmen and farmers will make full use of them. It is not that registered seed is necessarily better than non-registered seed ; in fact this year no fewer than nine samples of English Late-flowering, of which the counties of origin were unknown, were included in these trials and they all proved to be genuine Late-flowering and quite as vigorous as the registered samples. This does not, however, happen every year, and the getting of registered seed ensures that it is genuine.

There were altogether seventeen different samples of Montgomery and fifteen of Swedish in the trial, and all were genuine except one sample of each which contained a proportion of Broad-leaved. One sample of Montgomery, once grown in New Zealand, was quite as good as seed got direct from Montgomery.

American Mammoth has never done well here and all the eight samples included in the trial gave poorer returns than the English, Montgomery, or Swedish. A safe and useful blend is one-third each of these three.

In the case of the Broad-leaved the results were similar to those of previous years in that English and New Zealand samples were very vigorous and by far the best. English samples were obtained from several counties including Hertford, Somerset, Suffolk, Devon, Oxford, and Dorset (Marl), while there were several of which the counties were unknown.

Canadian, of which there were seven samples, and Chilian (four samples) might have been expected to do better than they usually do owing to the mild winter, but the results from them were much the same as those obtained in previous years. Two samples of Polish and one sample of Gloria were very poor, only a few delicate-looking clover plants being present in the hay. The sample of

Gloria contained about 95 per cent of very dark-coloured seed; this clearly indicates that the colour of the sample is not a reliable guide as to its value.

In the aftermath the English and New Zealand Broad-leaved were very conspicuous, while all the Late-flowerings were slow in developing.

All the samples of Red clover included in the above trial were sown in short rows in order to enable their peculiarities to be more closely studied. All the rows developed well, and a comparison of the following weights with those in the field trial will show that there is little connection between the results in the two trials.

| *Late-flowering—* | lb. | oz | *Broad-leaved—* | lb. | oz |
|---|---|---|---|---|---|
| American Mammoth | 5 | 0 | Canadian | 4 | 2 |
| Essex | 7 | 0 | Chilian | 3 | 4 |
| Montgomery | 8 | 8 | English | 5 | 0 |
| Suffolk | 6 | 8 | Gloria | 3 | 8 |
| Swedish | 10 | 6 | New Zealand | 4 | 10 |
| | | | Polish | 3 | 10 |

These results indicate that the grasses compete much more severely with some than with others. The only true trial with Red clovers is that which is carried out in the field when they are included as part of the usual seed mixture.

The effect of the variety of oat on the hay crop and especially on the amount of Red clovers present was well seen this year.

| Variety of Oat | Per acre<br>Red Clover<br>cwt. | Grass<br>cwt. | Total<br>cwt. |
|---|---|---|---|
| Castleton | 5·0 | 25·1 | 30·1 |
| Elder | 12·9 | 27·5 | 40·4 |
| Pure Line | 16·9 | 26·2 | 42·3 |
| Star | 15·2 | 23·5 | 38·7 |
| Victory | 13·4 | 25·3 | 38·7 |
| Yielder | 27·9 | 24·7 | 52·6 |

This shows distinctly the value of a thin-growing early variety like Yielder as a nurse crop, and on the other hand the very adverse effect of the later thicker stand of Castleton.

In several plots Italian ryegrass was included. As usual this grass was further advanced in spring than perennial ryegrass and showed little Red clover. Heavy rain in April followed by snow in May broke down the plants of Italian ryegrass so badly that they did not rise again and were badly bent, with the result that there was practically no Red clover at all even where as much as 8 lb. per acre of seed had been sown.

Most of the seed of Italian ryegrass comes from Ireland, France and Denmark. Last year there was a quantity from New Zealand and no fewer than fourteen different samples of this were obtained for trial. In order to compare their characteristics single plants of each were planted out. The average weight per plant was as follows :—

| | oz. | | oz. |
|---|---|---|---|
| Irish | 5·0 | New Zealand (6) | 5·3 |
| French | 3·0 | ,, (7) | 4·3 |
| Danish (1) | 4·5 | ,, (8) | 5·3 |
| ,, (2) Tystofte | 6·7 | ,, (9) | 4·7 |
| New Zealand (1) | 4·3 | ,, (10) | 4·3 |
| ,, (2) | 2·4 | ,, (11) | 6·6 |
| ,, (3) | 3·0 | ,, (12) | 6·0 |
| ,, (4) | 3·3 | ,, (13) | 4·3 |
| ,, (5) | 4·0 | ,, (14) | 3·0 |

These results show that as in previous trials French Italian ryegrass was inferior to Irish and Danish. Some of the New Zealand samples gave particularly good results, while others were poor. It is not known from what district of New Zealand the samples came.

In a field of third year's pasture there are several plots where Italian ryegrass had been included. In these plots daisies were very conspicuous during early summer, while in plots alongside where no Italian had been included there were very few daisies.

In order to test the value of shelled seeds of Timothy, four lots of 100 each were picked out of a sample and sown in rows alongside four similar lots of unshelled seeds. The average number of plants that came up were : shelled seed, 27 per cent ; unshelled seed, 84 per cent.

English Wild White clover sown both in rows and in the field in 1932 and 1933 were generally better than those of previous years. Out of twenty-five samples of Kent seed two were Early-flowering and distinctly poor. All the others were good. Good samples were also obtained from Suffolk, Essex, Bedford and Northampton, while one sample from Hertford and four samples out of five from Hereford were very poor. All the samples that did poorly gave a weak chemical reaction.

Among samples from New Zealand were a few of what are called Mother seed and permanent pasture. Mother seed is regarded by authorities in New Zealand as the best type, while permanent pasture is once grown from Mother seed.

The Mother seed gave a very strong chemical reaction and when sown in rows alone grew very vigorously, the leaves being very large. In the field, however, while it was quite good it was opener than where good English samples had been sown. The permanent pasture on the other hand gave a weak chemical reaction and the plants in rows were earlier in flowering and were not nearly so vigorous as the Mother seed, the leaves being much smaller. In the field the plots where they were included could easily be picked out, there being very little White clover even where up to 4 lb. of seed per acre had been sown, and the grasses showed a distinct yellow unhealthy colour apparently due to lack of nitrogen. Anyone sowing New Zealand White clover should make sure that it gives a strong chemical reaction.

Part of a field extending to about ½ acre which was sown in 1932 and hayed in 1933 was very poor in both grass and White clover; what grass there was looked very unhealthy. The opportunity was taken to lay down several plots in order if possible to effect an improvement. First of all a strip of the area was dressed in December 1933 with ground lime at the rate of 1 ton per acre. Cross plots were dressed at the same time with 9 cwt. slag and 3 cwt. potash salt, 9 cwt. ground mineral phosphate and 3 cwt. potash salt, 9 cwt. slag alone, and one with rotted dung at the rate of 12 tons per acre, while another plot got 4 cwt. superphosphate, and 3 cwt. potash salt in spring 1934. Strips were also sown at the same time with ¾ cwt. sulphate of ammonia, 1 cwt. nitro-chalk and 1 cwt. potash nitrate, while in another strip 2 lb. per acre of Wild White clover mixed with damp sifted soil was sown.

The dung showed a beneficial effect first, the grasses coming up thick and vigorous, but the plot was hardly eaten by the cattle either in 1934 or 1935, and the result of this is that very little White clover has come in and the pasture is now very rough.

All the manures led to a considerable improvement. Slag and potash was best, there being now a good thick sole with plenty of White clover, and the plot has been closely grazed. Where potash was omitted and slag only used the result was distinctly poorer, the White clover being very patchy. The superphosphate and potash plot is quite well covered with grass and clover, but it has not been so well grazed as the slag and potash plot. The ground mineral phosphate and potash plot has not been so good as either of these two.

The lime showed a slight improvement, but not so much as one might have expected. In the nitrogen strips the White clover came up more quickly and showed more vigour than where no nitrogen was used. The value of a dressing of a nitrogenous manure in the spring on second year's grass in assisting the development of Wild White clover has been noted in previous trials.

The most spectacular result however was seen in the strip where the Wild White clover was sown. It was not harrowed in, but fortunately there was rain a day or two after, and this no doubt was sufficient to enable it to braird. Even in the plots that got no manurial treatment there is now a good crop of White clover. The untreated plots are still very poor.

## *The Department of Botany, Edinburgh and East of Scotland College of Agriculture*

***Frost Damage.***—In this country damage by frost is always liable to occur in spring, but for the most part it is slight, and only occasionally is the destruction widespread. The spring of 1935 will be recorded and long remembered for the extensive damage caused not only to the more tender plants but even to forest trees. In some districts, after the frosts of mid-May, the tints of the tree foliage were more suggestive of autumn than of spring. Even coniferous trees suffered, particularly the spruce. Early potatoes suffered severely, while the damage to fruit blossom in some districts was exceptionally severe. In some mountain districts even Deer grass (*Scirpus*) was damaged.

Slight frosts do not always damage plants, especially if the weather is cold. When, however, the fall in temperature is very rapid, as it was on more than one occasion this year, damage is far more extensive. Frost damage in orchards is warded off in some places (especially in parts of the United States) by burning fires in braziers scattered throughout the orchard. In this country this is so seldom necessary that such costly methods are practically never used.

Frost affects the plant cells by withdrawing water from the protoplasm (living matter) of the cells. This water is found in the intercellular spaces where it will (or may) freeze. If the water withdrawn from the cell is not too great in quantity and the thaw is gradual, no damage may be done even to tender plants. If plants when " frozen " are roughly treated, they may be severely injured and the parts affected may not recover. This is seen on grasslands and on lawns where the grasses (and other plants) are frozen. The marks of footsteps, wheels, etc., show after the thaw in the damaged and killed vegetation. If, in freezing, too much water is withdrawn from the cell, death generally results. The action of freezing on the protoplasm of the cell is rather complex. There is not merely the drying action and mechanical injury to the membrane, but the precipitation of proteins. Some plants are naturally far more resistant to freezing and low temperatures than others, while the exact condition of the vegetative parts at the time of freezing is important. Hardy plants and those not readily affected by frost do not lose water from the cell so readily as do those which are liable to frost damage. To a certain extent plants can be hardened to temperatures considerably below normal by giving them a series of checks, known as a process of " hardening off." Damage to a delicate part of the flower such as the pistil is fatal, and no process of hardening can avert such harm.

*Yellow Rust of Wheat* (*Puccinia glumarum*).—This disease has become increasingly prevalent in the south-eastern part of Scotland during the last three years. Although known previously, it was not generally recognised, nor was it easily detected in passing fields. In many parts to-day fields can be seen to be not quite normal, and on close inspection this Yellow Rust is found. It is very common in many parts of England, and its prevalence has perhaps become greater owing to the recent marked increase in the acreage under wheat. The summer spores (yellow in colour—uredospores) are not easily affected by frost or cold weather, but may be even killed by high summer temperatures. The recent increase of the rust in certain parts of Scotland may be due to this peculiarity in relation to temperature, as well as to the more extensive sowing of wheat. The winter spores (black in colour—teleutospores) cannot infect wheat and the intermediate host which should produce the cluster-cup (Æcidial) stage is not known. Hence the spread must be by the yellow summer spores. Biological races of this fungus attack barley and rye, while several grasses are affected. In Britain, barley and rye are seldom attacked by this rust. It must, of course, be remembered that a number of other rusts attack grasses as well as cereals, including the Black Rust (*Puccinia graminis*).

Fortunately, Yellow Rust of Wheat does not generally do much damage. Sometimes the damage is negligible; it may at times amount to 5 per cent, and occasionally to 10 per cent decrease in yield. The rust chiefly affects the foliage, especially the older leaves, and this at times leads to lack of sufficient food to swell the grain. Further information is required regarding the fungus causing the disease and regarding other host plants, and also as to the extent and nature of the damage caused in Scotland.

*Field Pepperwort* (*Lepidium campestre*).—This biennial plant has small white flowers borne in clusters and belongs to the same family as the Turnip, Charlock and Shepherd's Purse. In height it seldom reaches more than a foot even in hay-fields and it is generally shorter. This plant should be carefully watched. It occurs in isolated places throughout Britain, but once it gets into arable land it may become a formidable pest. So far, there are no records of serious damage in Scotland, but that is generally the case until the plant in question has secured a firm hold in some agricultural district. It is frequently found at railway sidings—doubtless brought with straw and more particularly with hay or coarse grass used for packing. Farmers should therefore be extremely careful to burn all such material as soon as it reaches the farm. Further, those near a railway station with sidings where weeds are plentiful should be always on the outlook for any new plant that has gained access to their fields. In such matters the obvious remedy is to insist that such weeds should be killed within the area of the railways and the embankments, and that straw and packing should not be left lying about, but should be burned. There is a real danger of this and other weeds spreading from the sidings of railway stations, particularly in rural areas. Pepperwort, or Hoary Cress (*Lepidium draba*), is another species that requires watching, as it seems to be increasing. This weed is a perennial and causes heavy losses in Kent and Essex.

*Virus Diseases*.—For some time now virus diseases have occupied an important place among modern scientific problems. The difficulty is that unlike fungus diseases they cannot be prevented by spraying with certain chemicals. The diseases themselves are present in the sap of the plant and the results are usually reflected by decreased crop yields. Progress in the realm of these diseases is slow because of the initial difficulty of sifting out all the evidence and establishing conclusive facts. In the case of potatoes, which suffer from such virus diseases as Mosaic, Crinkle and Leaf Curl, the farmer must of necessity plant seed that has been produced from a crop guaranteed to attain a certain degree of freedom from those diseases.

*Sprain.*—Another disease that has attained prominence in recent years is that known as Sprain or Spraing. The variety Golden Wonder has recently suffered very much from a disease affecting the ring of vascular tissue just inside the tuber. So far no fungus or bacteria have been found in the samples received, and until a definite organism is located the disease cannot be accurately described as Sprain or Spraing. Its symptoms in the tuber resemble to some extent that described by Burr (1, 2) as Bacterial Necrosis, and more particularly to that known as Frost Necrosis in Canada.

The tomato is another plant that suffers severely from virus diseases, and the number of these seems to be steadily increasing. It is only recently that Spotted Wilt was announced as a new disease. Now it seems to be widespread and, being thrip-borne, is not always easy to control, especially when there are several host plants that support both the insect and the virus. Then to make matters worse, another new virus disease has just been described by K. M. Smith (3) in a letter to *Nature.*

It seems that at present a leaflet with brief descriptions of all the known virus diseases of the tomato is urgently required, with, if possible, drawings or photographs of affected plants showing the typical symptoms.

### REFERENCES

(1) Burr, S. M. 1928. "Sprain or Internal Rust Spot of Potato." *Ann. Applied Biol.*, vol. xv, No. 4.

(2) Burr, S. M. 1931. "Sprain or Internal Rust Spot of Potato (*B. rubefaciens*)." *Ibid.*, vol. xviii, No. 4.

(3) Smith, K. M. 1935. "A New Virus Disease of Tomatoes." *Nature*, vol. 135, No. 3422, p. 908.

## Overseas Notes

### FURNISHED BY THE MARKET SUPPLY COMMITTEE

*Measures to Improve French Meat Market.*—In the course of his report to the President of the French Republic on the new decrees, Monsieur Laval, the Prime Minister, drew attention to three decrees dealing with the meat market. The aim of the Government's action was two-fold; (1) to improve the position of the producers and ensure that they get a somewhat larger profit than they have been getting of late, and (2) to protect consumers by taking meat of bad quality off the market and bringing about a fall of retail prices.

One decree makes it possible to utilise the credits voted by Parliament and make immediate use of the laws for preventing bovine tuberculosis and cleaning up the meat market.

The Minister of Agriculture has proposed a decree which will enable the Government to take inferior animals off the market by direct purchase. These purchases will be made for cash on days advertised in advance by the authorities, and the business will be managed by special purchasing boards. The animals thus purchased, which may amount to about 150,000 head, will be slaughtered and the meat will be rendered uneatable and destroyed.

The second decree assures the Minister of Agriculture the credits necessary for establishing or improving slaughter-houses with modern equipment, and capable of treating the meat on the spot in the cheapest manner at centres of production.

Another decree authorises Prefects to fix a maximum retail price for meat in each Department should this be necessary. In fixing these prices, regard will be had to all the elements entering into the cost of production, particularly the wholesale prices paid by the butchers.

Butchers must be ready to give proof to the supervising officials that they have actually paid the prices. They must also show on tickets, one outside and the other inside the shop, the selling price of the cuts which have been controlled by the Prefects' order.

If the prices fixed are exceeded, the butchers will be brought before the Departmental Court which will have power to inflict punishment ranging from a simple warning to the closing of the shop for a given time.

Similar measures will apply to pork butchers.

*Germany's Growing Self-Sufficiency in Food.*—Self-sufficiency in food is the aim of the National Socialist agricultural policy and the ways and means of attaining the goal are set out by the party's Agricultural Group under the following ten heads.

1. Intensive cultivation of the soil by the more effective application of labour and machinery.
2. More intensive and effective manuring.
3. The use of good seed of recognised quality.
4. The development of rational mixed farming with a view to maintaining a steady return.
5. The rational distribution of the available area of land among the most important products that are at present unavailable, and in particular the production of a larger volume of forage crops.
6. The cultivation of green fodder as a by-product.

7. Improvements and reclamations of land.
8. Reduction of herds to the amount which can be supported by home-produced fodder, and the weeding-out of unproductive dairy cattle.
9. Improvement of cattle by selection of breeding stock.
10. Increase in the number of sheep.

The voluntary labour service is employed in connection with land improvement and reclamation and the use of more intensive methods. As regards point 5, substantial progress has been made in the matter of redistribution of the area under cultivation, a considerable area having been transferred from the raising of bread cereals to that of forage crops, particularly barley and oil seeds.

There is still a considerable deficit in the production of cattle fodder, whereas in normal seasons there is, on balance, an exportable surplus of bread cereals. The drought of 1934 led to a heavy increase in the imports of feeding stuffs and also to an increased demand for imported bread cereals. The summarised foreign trade figures are as follows :—

*Germany : Foreign Trade in Feeding Stuffs and Bread Cereals*

(In thousands of short tons : + = import surplus ; – = export surplus.)

| | September–April 1933-34 | September–April 1934-35 |
|---|---|---|
| *Feeding Stuffs* | | |
| Fodder barley . . | + 231 | + 394 |
| Oats . . . . | – 82 | + 175 |
| Maize . . . . | + 211 | + 352 |
| Total | + 360 | + 921 |
| *Bread Cereals* | | |
| (rye and wheat) . . . | – 120 | + 478 |

The difficulties of the fodder situation led to a reduction in the numbers of live stock, particularly oxen and pigs. In 1934 cattle were reduced by over half a million, pigs by 750,000 and poultry by two million. The fall is to be made good by improvement in productivity. Thus about one million cows, *i.e.* about 10 per cent of the dairy herd, have been subjected to "productivity control." These cows supply an annual average of 3500 litres of milk as compared with an average of 2350 litres for the dairy herd as a whole. If the daily milk output could be increased by 1 litre per cow the whole milk requirements of Germany for all purposes could be obtained without recourse to imports, amounting at present to a milk equivalent of 2200 million litres per annum. Similarly, the output of pig products, which provide two-thirds of Germany's pork requirements and about 300,000 tons of fat per annum, could be considerably augmented without any increase in the fodder requirements if more attention were paid to breeding and feeding.

The present position with regard to self-sufficiency in food is summarised in the following statement which is based on estimates computed by the Institut fur Konjunkturforschung. Allowance has been made for imports of feeding stuffs.

*Germany : Proportion of Home Production to Home Consumption of Foodstuffs and Agricultural Raw Materials*

| | Per cent |
|---|---|
| Rye, wheat, barley, oats, potatoes, sugar, meat (other than pig meat), liquid milk, hops | 98-100 |
| Bacon, fresh-water fish, vegetables | 90-97 |
| Pig meat, fruit | 80-90 |
| Poultry, eggs, timber | 70-79 |
| Sea fish | 60-70 |
| All fats (including margarine and lard), hides, skins | 50-59 |
| Leguminous produce | 40-49 |
| Tobacco | 20-39 |
| Flax, tannin | 10-19 |
| Wool | 5-9 |
| Oilseeds, oilcakes, vegetable oils | 1-4 |

The estimates indicate that as regards food, allowance being made for imported feeding stuffs, about 80 per cent of the total requirements can be supplied from home sources under normal harvest conditions. The most serious deficiencies occur in the case of fats as well as in textile raw materials and other industrial raw materials. Many of these products cannot be produced under a system of intensive agriculture and for this reason the idea of self-sufficiency cannot be pushed too far.

*Food Prices and Wages in Germany.*—Recent press notices outside Germany draw attention to a growing shortage of foodstuffs in that country, attended by a rising tendency in retail prices. Some confirmation of these reports, so far as prices are concerned, is forthcoming from the German official statistics. The official cost-of-living figure for food in June 1935 was 120·6 (1913-14=100), as against 117·8 in June 1934 and 113·7 in June 1933.

The relation of German food prices to wages was treated in a novel manner in an article published a short time ago in the *Prager Tagblatt.* A comparison was made of retail prices and workers' wages in Prague and a German provincial town of about the same size. For Germany the official figures of food prices in April and May 1935 were taken. The information in regard to wages came from the statistics published by the International Labour Bureau.

From the data collected the following comparison of food prices was made :—

| | | Prague (Kronen) | German Town (Kronen) |
|---|---|---|---|
| Bread . . . | 1 kilo | 2.40 to 3.00 | 3.50 |
| Roll . . . | 1 | 0.25 | 0.40 |
| Flour (foreign) . . | 1 kilo | 3.10 | 5.60 |
| Beef . . . | ,, | 12.00 to 16.00 | 24.00 |
| Veal (good) . . | ,, | 18.00 to 24.00 | 32.00 to 34.00 |
| Fowl (average) . . | 1 | 16.00 | 23.00 |
| Egg (April) . . | 1 | .60 | 1.20 |
| Cooking butter . . | 1 kilo | 16.00 to 18.00 | 29.00 |
| Milk . . . | 1 litre | 1.60 | 2.70 |
| Coffee (prime quality) | 1 kilo | 56.00 | 70.00 |
| Loaf sugar . . | ,, | 6.30 | 8.80 |
| Rice (medium quality) | ,, | 3.00 | 5.60 |
| Apples (good) . . | ,, | 10.00 | 11.00 |
| Orange . . . | 1 | 0.80 | 1.20 |

Food prices, especially those of eggs, butter and meat, have always been lower in Czechoslovakia, but there is little difference between the two countries as regards rent, light, heat and clothing. On the whole, the cost of living in the German provincial town is said to be about one-third higher than in Prague, while net wages are now at about the same level.

German wages fell by about 22 per cent between 1930 and 1934, while contributions for social services increased. During the same period wages in Prague showed little or no change.

*Propaganda to Encourage Milk Consumption in Belgium.*—At the first meeting of the committee which was recently appointed under the chairmanship of the Minister of Agriculture to develop milk consumption in Belgium, the Ministry's Principal Inspector, who is Commissioner-general for Propaganda, outlined the directions which propaganda should take, as follows :—

(1) Among producers : improved hygiene in cowsheds. To this end, special efforts should be made by (*a*) agriculturists working in conjunction with producers for the large centres, (*b*) veterinary inspectors in fighting disease, (*c*) agricultural associations in reaching the small farmer.

(2) Among distributors : delivery of milk to the consumer in the best possible condition. To this end, the efficient collaboration of the various health services and the representatives of the milk trade associations was desired.

(3) Among consumers : popular education in regard to the nutritive value of milk and the advantages of its consumption. To this end the collaboration of the teaching

profession, delegates of the Youth Association, doctors, nurses, and Women's Institutes was requested.

A " milk week " was announced to take place in September, to be preceded and succeeded by continuous propaganda.

*Decline in Beef Consumption in Austria.*—One of the reasons advanced by the Vice-President of the " Committee of Action for Increasing Consumption of National Agricultural Produce " for the so-called " flight from beef " is that the modern housewife cannot devote the same time and care to the preparation of food as formerly, and that beef dishes in respect of the time and cost of preparation are the most expensive. She accordingly resorts to other kinds of meat. The quality of beef in recent years has rather deteriorated, and the poorer the quality, the greater is the cost of preparation and the less satisfactory the result. The increasing demand for pig meat, at the expense of beef, is due to the fact that the majority of the animals are under one year when slaughtered, and that the breeding and feeding methods aim at providing tasty meat. The preparation for the table of such meat in homes and restaurants takes about a third of the time required for beef and less goes in waste.

Owing to the decline in consumption of beef, only 1600 to 1800 head of cattle are now required to cover Vienna's weekly requirements, as against 4000 to 5000 before the war. The collapse of the cattle market and enormous losses to agriculture were only prevented by the introduction of Government measures for the regulation of the cattle industry. Although a fall in price was avoided, the problem of the profitable sale of the surplus cattle was not solved. To relieve certain markets, cattle were bought by the Government and the meat partly distributed in winter relief, partly preserved and partly used for the manufacture of feeding cake. This has only solved the problem temporarily and other possibilities for increased home consumption must be sought.

In this connection the Vice-President draws attention to the possibilities of " liquefaction " of beef. Experiments in this direction have already met with success. Fluid beef, with the addition of hot water, makes a good bouillon. Thickened, in the form of paste it could be spread on bread, or used in the preparation of other foods. A considerable number of lean beasts, whose value for slaughtering purposes is at present small, could be profitably disposed of for the preparation of this article of food.

*American Criticism of International Wheat Control.*—Mr Alonzo E. Taylor, one of the Directors of the Food Research Institute, Stanford University, California, examines in the June issue of *Wheat Studies*, published by the Institute, the prospects of an international solution of the wheat problem. His conclusions, which are extremely pessimistic, are to the effect that wheat is " inherently unadapted to international control," and he is extremely sceptical of any extension of regulation on a world basis. He bases his opinion on the following facts :—

(1) In order to attain an international adjustment of the production and consumption of wheat, it is essential to secure reliable estimates of the harvest and of the requirements. Experience has shown that such estimates are extremely hazardous and that the published figures rarely agree amongst themselves or with the final results.

(2) The problem moreover is not one merely of quantities, as is the case with metals. There are many sorts of wheat and the utilisation of each is different. This complicates the allocation to each country of a simple global figure.

(3) Even supposing these difficulties surmounted, there remains the problem of the fixation of the requirements of the importing countries. These are dependent upon the previous imports, average *per caput* consumption, estimated harvest and import quota. Thus a large number of unknown factors enter into the problem.

(4) Moreover the principle of the reduction of the sown area has so far nowhere been admitted, except in the United States. The various methods of realising such reduction are then examined ; persuasion, subsidies, compulsion, State purchase of land. The agreement of the different Governments upon the choice of a sole method seems to Mr Taylor problematic and he mentions a further one upon which however he does not insist, namely the fall in price, the consequential bankruptcy of producers and the forced sale of their farms.

(5) With regard to the control of prices, Mr Taylor is extremely doubtful as to its practicability in view of the divergence of types and qualities, but above all owing to the difficulty of determining the origin of wheat emanating from five or six exporting countries and entering ten or twelve importing countries. He points out in this connection that it is already extremely difficult to differentiate at the European ports between United States and Canadian wheat. Similarly the control of stocks will be in practice almost impossible in the absence of complete and reliable statistics.

(6) Finally, Mr Taylor maintains that in any case international regulation of the wheat market will be without the slightest chance of success so long as international monetary stabilisation has not been achieved. But even if this were attained, the lack of discipline in importing and exporting countries would prevent the execution of any agreed plan.

# Reviews

*Proceedings of the Third International Conference of Agricultural Economists.* Oxford University Press. 1935. Pp. xi., 498. Price 17s. 6d.

Agricultural economists from all over the world, some 200 in number, attended the Third International Conference at Bad Eilsen, Germany, between 26th August and 2nd September 1934. It was natural, in view of the gravity of world conditions during the years 1930-34, that the whole time of the Conference should be taken up with the study of national and international agricultural policies. That a very wide and comprehensive field was covered is shown by the size of the volume.

The programme of the Conference was divided into four sections. The first consisted of papers dealing with the national policies of Great Britain, Switzerland, Germany, Italy, Holland, Danubian countries, British India, Canada and U.S.A., special emphasis being laid on the forms, stages and limits of economic planning. These countries were representative of different types. The first two are deficit countries with intensive farming methods; Germany and Italy are deficit countries approaching self-sufficiency; Holland on the other hand is a surplus country with an intensive agriculture; while the Danubian countries and India are surplus countries with a peasant agriculture; Canada and U.S.A. again form a class to themselves. The second section dealt with the fundamental cleavage in the social and economic organisation of farms as witnessed by the peasant system on the one hand and the Russian collectivist experiment on the other.

The third section comprised two papers dealing with population problems as affecting the supply of and demand for agricultural commodities, while the fourth section dealt with the more universal economic problems for which international solutions are sought, such as questions of currency and debts, trade agreements and international agreement for control of production and marketing.

Some 29 papers, presented by many eminent delegates, fulfilled this programme and are reproduced here. The reader perusing this most interesting record cannot but be a little bewildered at the variety of forms which agriculture takes in different parts of the world, and at the numerous problems that arise in consequence, and he will be still more bewildered when he examines what each country has done or is intending to do to solve its own particular problems. He can be excused if he finishes his reading with the feeling that many of these national agricultural policies create more and bigger problems than they solve. Political and social considerations so often outweigh the economic implication of policies affecting agriculture that the agricultural economist has rather a thankless task. Nevertheless there was never greater need of his help and guidance if the efforts made to assist the agricultural industry are to achieve any lasting success.

This publication must rank with and supplement the World Economic Surveys issued by the League of Nations. The value attaching to such a pooling of knowledge and experience on the part of an important body of research workers cannot be overestimated, but it is to be regretted that their coming together has not resulted in any appreciable discussion of the papers presented. Whether this is due to an overloading of the programme with papers is not clear, but a published record of such a conference as this is robbed of a great deal of its value and interest if there is not also a record of critical and authoritative discussion.

*Dairy Produce Supplies in* 1934. Imperial Economic Committee. H.M.S.O. Price 1s. 6d. net (by post, 1s. 9d.).

This valuable report covers poultry and pig products as well as dairy produce.

The United Kingdom has for long figured as the world's largest importer of dairy produce and allied products, and its share of world imports again increased in 1934. For many agricultural products the year 1934 marked a turning point in the long downward trend of prices, yet for dairy products, as a whole, values declined further and total imports cost £2,000,000 less than in 1933. The value of butter imports exceeded that of any other food commodity and bacon displaced wheat as the second most important item. The growing share of Empire countries in the total imports of dairy, pig and poultry products has been a feature of the trade in recent years and the advance was continued in 1934.

World trade in butter increased by 6 per cent in 1934. But imports into the United Kingdom, amounting to 9,700,000 cwt. valued at £33,300,000, showed an even greater increase in volume and represented 85 per cent of the total butter entering world trade, compared with 83 per cent in 1933 and 64 per cent in 1930. The consumption of butter in the United Kingdom in 1934 was equivalent to 25·2 lb. per head, an increase of 6·5 lb. since 1930. New Zealand for the first time supplanted Denmark as the principal source of imported butter, and Empire supplies as a whole comprised 54 per cent of total imports, which is the largest proportion recorded.

The volume of cheese entering international trade has declined in recent years. Imports into the United Kingdom, on the other hand, have remained remarkably stable at approximately 3,000,000 cwt. per annum. Empire countries accounted for 92 per cent of the imports in 1934, New Zealand alone supplying 70 per cent. Prices for both butter and cheese in 1934 were lower than in the previous year.

World trade in eggs has fallen off by 30 per cent during the past five years. The United Kingdom imported 187,000,000 dozen in 1934, yet over two-thirds of the eggs consumed were home-produced.

Total consumption last year is estimated to have been at the rate of 151 per head, compared with 149 in 1933. Denmark easily maintained her position as the chief source of imported eggs, accounting for fully one-third of the imports, or more than all Empire countries combined; the Irish Free State and Australia occupied second and third positions.

The restriction of imports of bacon by quota was continued in 1934 and total imports, amounting to 7,600,000 cwt., were 1,500,000 cwt. smaller than in 1933. Denmark, which sent 56 per cent of the total, remained by far the largest source, but a feature of the trade was the development of Empire supplies, which accounted for 17 per cent of all imports, compared with only 8 per cent in 1933. Bacon prices in 1934 were substantially higher than in the preceding year.

In addition to the comprehensive figures for the United Kingdom, statistics of the external trade in dairy produce of other countries are included, and also an account of the measures undertaken by foreign Governments for the support of the industry. The effect of the operation of the Milk and Pig Schemes on home supplies is considered in Appendixes. In this connection, the rapid change over from factory to farm production of butter and cheese in the past year or two is a feature of considerable interest.

*Fruit—World Production and Trade.* Imperial Economic Committee. H.M.S.O. Price 1s. net (by post, 1s. 2d.).

It appears from this report that the volume of trade in fruit has advanced not only since the War, but also during the economic depression. For various reasons complete and reliable figures of production are difficult to come by. For several fruits the increase in production since the War cannot be precisely stated. The increase has been large, particularly in those countries where fruit is grown exclusively or mainly for export. The industry could not hope to escape altogether the effects of the world depression, but it does not appear to have suffered as severely as might have been feared.

The exports of citrus fruits in 1933 were 30 per cent higher than the average of the years 1927-31. Spain still provides more than half the citrus total and her annual exports have on occasion exceeded a million tons. But other producers of citrus fruits are noticeably extending their shipments, in particular, Palestine, South Africa and Brazil.

The international trade in apples has also increased but at a rate not comparable with the above. Fruit exports from Empire countries have fully shared in the development of world exports. In 1933 exports of apples from Canada, Australia and New Zealand were double the 1927-31 average. Exports of pears from Australia, of citrus fruits from South Africa and Palestine, of grapes from

South Africa, of raisins and currants from Australia and South Africa, and of canned fruits from Malaya, Canada, Australia and South Africa were in each case substantially greater in 1933 than the average of the years 1927-31.

The Empire as a whole, however, still remains a net importer of all the important fruits with the exception, in normal years, of bananas. This is due to the heavy import of fruits into the United Kingdom and Canada. Nevertheless, the dependence on foreign supplies is lessening. Thus net imports of apples in 1933 amounted only to 73,000 tons, compared with an average of 160,000 tons in the previous five years.

Among all importing countries, the United Kingdom is by far the most important and on an average is the world's largest import market for apples, pears, oranges, lemons, raisins and currants, and canned fruits. Germany comes next in importance as an import market for those products, and is the world's largest importer of fresh grapes. Other European markets are also increasing in importance as outlets for surplus fruit supplies. The United States, in view of her own large production, is not an important importer of fresh fruit, except bananas, of which her imports are by far the largest in the world, averaging annually about three times those of the United Kingdom.

A distinctive feature of the United Kingdom trade during recent years has been the growth of imports from the Empire countries. In the past five years apple imports have averaged 300,000 tons, of which 60 per cent came from the Empire, principally Canada, Australia and New Zealand. In 1934 the proportion was 77 per cent. Of pear imports, 36 per cent were of Empire origin. The bulk of the orange imports, averaging 520,000 tons, still comes from foreign countries, but Empire supplies account for nearly 30 per cent of the total and the proportion is increasing. More than half the banana imports of 325,000 tons come from the British West Indies. Empire countries, principally Australia and South Africa, send to the United Kingdom 30 per cent of her average imports, amounting to 127,000 tons, of raisins and currants. In 1934 the proportion rose to 45 per cent. Annual imports of canned fruits have of late averaged 150,000 tons, of which 40 per cent came from the Empire overseas. In 1928 the Empire contribution was only 28 per cent. In 1934 it had risen to 44 per cent.

*Fruit Supplies in* 1934. Imperial Economic Committee. H.M.S.O. Price 1s. 6d. net (by post, 1s. 9d.).

In this report attention is more particularly focused on the amount of fruit available for consumption in the United Kingdom. Although imports of raw fruit in 1934 were over 100,000 tons below the record quantity imported in the previous year, the inhabitants of the United Kingdom ate more fruit than ever before. This was due to a bounteous home crop, especially of apples, which brought the total available supplies up to a figure rendering possible a *per caput* consumption of nearly 96 lb., as compared with about 70 lb. in 1924 and 88 lb. in 1933.

Although the production of fruit in the United Kingdom is increasing, on an average about three-quarters of the supplies available for consumption are imported from overseas. For the five years 1929-33 the total imports averaged well over 1,250,000 tons, as compared with less than 750,000 tons in the period 1909-13. The bulk of the total is still supplied by foreign countries, imports from which are some 50 per cent greater than in pre-war years, but a relatively much greater advance has been made by Empire countries, whose contributions in the five years 1929-33 averaged more than four times the pre-war quantity.

Imports of raw fruit from Empire countries reached a new high level in 1934, accounting for 622,000 tons out of a total from all sources of 1,354,000 tons. This quantity represented nearly 46 per cent, as compared with the previous highest figure of 41 per cent in 1933 and an average of only 20 per cent in 1919-23. Imports of fresh fruit from Canada and Australia, which consist principally of apples, were smaller in 1934 than in 1933, but there were increased supplies from South Africa, New Zealand, the British West Indies and Palestine, the aggregate quantities of fruit received from South Africa and Palestine constituting new records, while those from New Zealand and the British West Indies were heavier than in any year except 1932.

The survey, in addition to its analysis of the imported supplies of fresh fruit in the United Kingdom, contains brief reviews of the trade in other countries, and should be invaluable to all those interested in an Empire industry of growing importance.

*Bulletins of the Ministry of Agriculture and Fisheries.* To be obtained from H.M. Stationery Office, 120 George Street, Edinburgh, either directly or through any bookseller at the prices stated, which do not include postage.

*Bulletin No.* 32. *Edible and Poisonous Fungi* (3s. 6d.).—In 1910 the Ministry of Agriculture published a small handbook illustrated with coloured plates for the purpose of facilitating the identification of the more common edible and poisonous fungi. So great was the demand for this book that it quickly ran out of print, and although two more editions have since been published the demand has been such that a new and up-to-date edition is now called for.

The fourth edition, now published, follows the same general lines as its predecessors. New plates have been added while some of the previous ones have been improved upon. The plates are in all cases excellent representations of the different fungi studied.

A simple yet adequate description of each of the fungi is to be found opposite each plate. In this description technical terms have been avoided as far as possible. For the few used, a glossary is provided, so that the book adequately meets the needs of the general public.

*Bulletin No.* 80. *Green Peas.* 1s. 6d.—This new bulletin ably maintains the standard set by its predecessors and comes at an opportune time.

During the past ten years there has been a remarkable development in the canning industry in this country which enables fresh green peas to be placed on the table throughout the year, while it has been possible to build up a foreign market in canned peas. To cope with the demand, the acreage under green peas has been considerably increased. The present bulletin provides information as to the types and varieties of peas that may be grown successfully in the British Isles and the methods of cultivation practised both in the garden and field, and the various insect and fungoid pests affecting this crop are fully dealt with.

Every commercial pea-grower would be well advised to obtain a copy of this bulletin, which extends to 73 pages and contains excellent illustrations.

*Bulletin No.* 83. *Experiments on In-breeding Poultry.* 1s.—For review, see page 194 (April 1935).

*Bulletin No.* 91. *Experiments in Table Poultry Production.* 1s. —Since the war there has been a remarkable development in the poultry industry. This has been most markedly shown in the increase in the number of fowls kept, in the rise in the laying capacity of the average fowl, and in the improvement in the methods of management. One aspect of the industry, which unfortunately has not kept pace with this development, is that part concerned with the production of table birds. So far from advances being made here, it would appear that the movement in recent years has been a retrograde one. High egg-laying capacity has, in effect, resulted in glutting the market with birds of unsuitable type and inferior quality.

Poultry-breeders now realise that more attention should be paid to the breeding and management of birds with good table qualities. In order to obtain authoritative information on this point, trials were started in 1925 by a Sub-Committee of the National Poultry Institute Advisory Committee at the South-Eastern Agricultural College, Wye, Kent.

This bulletin gives a summary of the results obtained during the various phases of the investigation. During the first period, 1925-29, information was gained regarding the best methods of feeding and marketing table poultry produced as a by-product on commercial egg farms. Opportunity was taken to compare the birds thus produced with birds bred specially for table production. A previous bulletin, No. 18 (now out of print), gave the results of this investigation.

It would appear from these trials that although the Rhode Island Red breed was not greatly inferior to the Light Sussex in the early periods and at 25 weeks of age, at practically every period the table breeds were definitely superior to the egg breeds.

During the years 1929-30 the object of the trials was to find out the relative values of dry as against wet mash. Although dry mash was superior to wet mash as a rearing ration, the difference, taking everything into consideration, was practically negligible. There was, however, a saving in labour charges when dry mash was used. In the two following years the question of costs of the fattening ration was dealt with. It was found that barley meal and maize could partially replace Sussex ground oats and that the dried milk ration could be reduced by some 50 per cent without reducing the gain in weight or the quality of the flesh. Throughout the report many interesting points are dealt with, such as the best time of year to hatch chickens so as to obtain the best market.

This bulletin comes at an opportune time. The gradual narrowing of the margin between the cost of production of eggs and the price realised has made it imperative that more attention be paid to producing table birds of high quality. Up-to-date information on all points connected with the production of birds for the table will be found in this bulletin, which at the price of one shilling is a remarkably cheap and well-produced publication.

*Bulletin No.* 93. *Pests and Diseases of the Sugar Beet.* 1s. 6d.—Sugar beet has been introduced in Great Britain as a farm crop in comparatively recent years. For this reason, and because it has been grown from seed, it has to a large extent escaped most of the insect and fungoid pests associated with it in those continental areas where it has been largely grown for a long series of years.

Unfortunately, this state of comparative immunity from pests no longer exists. In some areas troubles have already broken out, and there are indications that these will spread fairly rapidly in the near future, unless methods of control are practised. The present publication is intended, therefore, to provide authoritative information as to the nature, appearance and methods of control of the various sugar-beet diseases.

In order to provide an authoritative report, the authors of the bulletin visited all the Central European and Scandinavian countries in which this crop is grown and there studied the subject at first hand.

The report, which extends to 57 pages, is well illustrated throughout. It should serve a most useful purpose in providing information whereby outbreaks of disease can be readily recognised and measures of control promptly taken.

*Garden Pests.* David Robertson, Ph.D., B.Sc.(Agr.), N.D.A. (North of Scotland College of Agriculture). Pp. 32. Price 1s.

Mr Robertson, who is Lecturer in Agricultural Zoology at the North of Scotland College, has prepared a very practical pamphlet on the subject of garden pests. Aiming at brevity, he has confined himself to the practical points, viz., symptoms and control, and has thus been able to cover forty of the commoner pests of fruit, vegetables and glasshouse plants in about 20 pages. A section at the end deals with the various kinds of insecticide—stomach poisons, contact poisons and fumigants. Mr Robertson's clear and concise treatment of his subject justifies a cordial recommendation of his pamphlet, particularly to the inexperienced gardener who is perplexed by the numerous enemies he encounters.

*Potato Varieties of the German Official List* (translation of title). Dr Karl Snell and Hans Geyer. Paul Parey, Berlin, 1935. Price Rm. 1.80.

An attempt is being made in Germany at present to encourage the planting of only the best seed of the best potato varieties. Although any farmer, whose holding is not situated in an area infested with wart disease, may plant any variety, the authorities have now decided that only those varieties on the official list can be inspected and certified ; further, as a result of an official order, only certified seed can be brought into commerce from 1936 onwards. This means that the growing of many of the older and inferior German varieties will shortly cease. New varieties, however, may be added to the official list, provided they are immune from wart disease, are distinct, and have passed a two-years test at thirty centres distributed over the entire country. As new varieties are added to the list, the older varieties will be dropped, so that the number on the list will remain constant.

The greater part of the book is taken up with the description of the varieties on the official list. There is, however, a general section in which the various characters useful in the identification of potato varieties are described. The descriptions of the varieties are not confined to botanical characters : useful commercial points, *e.g.* adaptability to particular environments, resistance to ordinary scab and sprain, cooking quality, and cropping capacity, are added.

The senior author is a well-known and trustworthy continental writer, and the book may be recommended with confidence to readers of German who are interested in the subject.

It is also thought that the brief description of the German scheme here given will be of general interest.

*The Differentiation of Wheat Varieties by the Grain and in the Laboratory* (translation of title). J. Voss (papers of the Biological Institute, Berlin-Dahlem), vol. 51, July 1935. Paul Parey, Berlin.

The importance of purity in cereal stocks appears to be more widely recognised in Germany than in this country, and this booklet gives an account of methods used in Germany to discriminate amongst wheat varieties. Morphological characters naturally are the most important, but the utility of such tests as the fluorescence and phenol tests is stressed.

A large number of German varieties is described.

The booklet should be useful to agricultural botanists and those interested in the seed trade who read German.

## Official Statistics

THERE is to-day, both in public administration and in private enterprise, an increasing tendency to plan for the future in the light of the accumulated experience of the past. This tendency has not only invested with a new importance the collection and publication of statistical information on a very wide range of subjects ; it has also emphasised the need for a directory of published material such as is afforded by the *Guide to Current Official Statistics.*

Prepared under the auspices of a permanent Committee of Departmental statisticians, this annual volume provides a comprehensive index to the extensive numerical data published each year in the form of official reports, returns, accounts and periodicals ; and its contents are arranged on a plan which enables the investigator to compile, in the space of a few minutes, a complete list of sources of information on the subject of his inquiry. The degree of analysis of the figures, the date and place to which they relate, and the prices of the volumes in which they are to be found, are also indicated.

Volume XIII of this indispensable handbook has just been issued. It deals with the statistics published in 1934, contains 350 pages, and costs 1s. net, or by post 1s. 5d. It may be obtained direct from the sale offices of H.M. Stationery Office or through any bookseller.

Certain of the earlier volumes, dealing with the statistics of previous years, are also available at the same price.

## Prize Essays in Agricultural Economics

The Agricultural Economics Society has decided to offer two annual prizes of £10 and £5 respectively for essays on subjects connected with the economics of agriculture. Competitors must be either students at recognised institutions or holders (of not more than two years standing) of degrees and/or diplomas in agriculture and/or economics. Essays for the current year must be sent in by the 30th June 1936, and must be on one of the following subjects :

(*a*) The influences of machinery on systems of agricultural production in Great Britain *either* (*a*) 1870-1913, or (*b*) 1914-1935.

(*b*) Rationalisation of British agriculture and the system of land tenure.

(*c*) Influences of British international loans on imports of foodstuffs and agricultural production in Great Britain.

(*d*) Influences of consumers' demands on agricultural production.

(*e*) Trends of production in British agriculture.

Further particulars of the conditions can be obtained from the Honorary Secretary, the Agricultural Economics Society, University of Reading, 7 Redlands Road, Reading.

## Wireless Talks on Agriculture, 1935

### SCOTTISH

Oct. 24. Field Drainage. Mr J. R. M'Callum.
Nov. 1. Our Children's Scotland—
        (3) Agriculture. Sir Robert Greig.
,, 7. Reclamation of Waste Land. Dr W. G. Ogg.
,, 21. Small-holdings
        (1) Settlement.
,, 28. (2) Management.
Dec. 5. (3) Results.

### NATIONAL

Wednesdays. For Farmers Only. Professor J. A. Scott Watson.

The subjects will include disease in dairy herds ; reduction in cost of fattening bullocks ; hill sheep-farming problems ; market gardening ; poultry ; the cider industry ; sugar beet ; the work of the veterinary research officer. In some cases an expert will discuss the question with Professor Watson.

### NORTH REGIONAL

Nov. 1. The London Dairy Show. Mr W. B. Mercer.
,, 29. For Northern Farmers in Particular. Mr J. A. Hanley.
Dec. 27. ,, ,, ,, ,, Mr W. B. Mercer.

### MIDLAND REGIONAL

Dec. 12. The Smithfield Show. Messrs W. B. Thompson and A. W. Ling.

### NORTHERN IRELAND

Monthly. Farmers' Work and Worry. Mr P. Fitzpatrick.
Fortnightly. For Ulster Farmers. Arranged by the Ministry of Agriculture.

# Agricultural Returns for Scotland, 1935

*Crops and Grass.*—The Preliminary Statement of the Agricultural Returns taken in Scotland as at 4th June 1935 shows that the total area under crops and grass amounts to 4,591,400 acres, comprising 2,975,300 acres of arable land and 1,616,100 acres under permanent grass. The total acreage is the smallest recorded since 1874 and is less by 9000 acres than that returned in 1934. The area of arable land is the smallest recorded since the Returns were first taken in 1866, being less than in 1934 by 16,300 acres, while the area under permanent grass has increased this year by 7300 acres and is once more the largest on record.

The area under rotation grasses and clover, 1,413,600 acres, has decreased by 3200 acres, while the " tillage " area, *i.e.* that under grain, green crops, etc., is smaller by 13,100 acres than in 1934. Reductions in the areas under barley, potatoes, turnips and swedes, sugar beet, and vetches, tares, etc., for fodder, amount in all to 30,900 acres. Increases in the areas under wheat and oats amount to 12,900 acres, while mixed grain, rye, beans, peas, mangolds, cabbage, rape, other crops and bare fallow show a collective increase of 4900 acres.

The outstanding features of the crop returns are the increases in the areas under wheat and oats, and the decreases in barley and potatoes. Wheat, with an increase of 3400 acres, or 3·5 per cent over 1934, reaches an area of 101,000 acres, which is the highest recorded since 1875. Oats have increased by 9500 acres to 826,000 acres. Barley has lost more than half the increase achieved last year and now covers 77,000 acres, the decrease being 19,300 acres, or 20·1 per cent. The area under potatoes has decreased by 8000 acres to 132,000 acres. Turnips and swedes show a relatively small diminution, and sugar beet has lost 100 acres, while the area under small fruit remains unchanged at 9600 acres. Beans and peas show increases of 300 and 200 acres respectively, while vetches, etc., for fodder, show a decrease of 1100 acres. These changes may be connected with an alteration in the arrangement of the schedule made this year.

Of the area under permanent grass, 184,600 acres were cut for hay and 1,431,500 acres were grazed, while of the area under rotation grasses and clover, 394,800 acres were cut for hay and 1,018,800 acres were grazed. The area under permanent grass for mowing was greater than in 1934 by 3900 acres, and that under rotation grass for mowing by 1000 acres; the total area cut for hay is thus increased by 4900 acres.

*Live Stock.*—The live-stock returns show that horses have decreased in numbers, while cattle, sheep and pigs have increased.

Horses used for agricultural purposes are fewer than in 1934 by 1500, the total, 110,500, being the smallest on record. Unbroken horses of one year and above show an increase of 1000, or 6·7 per cent, while the number of foals is larger by 100, or 1·7 per cent. The decrease in the number of horses of all kinds is 900 or 0·6 per cent.

The total number of cattle, 1,316,000, is greater than in 1934 by 2800, or 0·2 per cent. While heifers in calf and " other cattle " under one year are fewer by 1700 and 3700 respectively, all the other class of cattle show increases.

The total number of sheep, 7,755,800, shows an increase of 100,800, or 1·3 per cent, as compared with 1934. Ewes, which number 3,334,000, are 20,000, or 0·6 per cent, fewer than in 1934, and rams have declined by 1200, whereas lambs show an increase of 108,000, or 3·3 per cent, and " other sheep " one year old and above are more numerous by 14,000, or 1·5 per cent.

Pigs, which reached the record number of 206,300 last year, show a remarkable increase, the total this year being 255,500, which exceeds last year's figure by 23·8 per cent. Sows are more numerous by 4200, or 14·8 per cent, boars by 200, or 7·1 per cent, and other pigs by 44,800, or 25·6 per cent.

The returns of fowls and ducks are given below. Those of turkeys and geese will be issued later. Following on a slight reduction last year, fowls now show a decrease of 249,000, or 3·1 per cent, while ducks have increased by 19,300, or 8·1 per cent.

*Labour.*—The returns of labour employed at 4th June (excluding occupiers of holdings, their wives, and domestic servants) are given below. Regular male workers are fewer than in 1934 by 600 and female workers by 800, while casual workers show a diminution of 400.

| | 1935 | 1934 |
|---|---|---|
| *Regular Workers*— | | |
| (*a*) Males, 21 years old and over | 58,900 | 59,200 |
| (*b*) Males under 21 years old | 19,300 | 19,600 |
| (*c*) Women and Girls | 17,700 | 18,500 |
| *Casual Workers*— | | |
| (*a*) Males, 21 years old and over | 6,700 | 6,800 |
| (*b*) Males under 21 years old | 2,900 | 3,000 |
| (*c*) Women and Girls | 6,000 | 6,200 |
| Totals | 111,500 | 113,300 |

| | 1935 | 1934 |
|---|---|---|
| Fowls over six months old | 3,790,000 | 3,831,000 |
| Fowls under six months old | 3,990,000 | 4,198,000 |
| Totals | 7,780,000 | 8,029,000 |
| Ducks over six months old | 156,500 | 159,300 |
| Ducks under six months old | 101,000 | 78,900 |
| Totals | 257,500 | 238,200 |

*Varieties of Potatoes.*—There is given below a Preliminary Statement compiled from the returns of varieties of potatoes grown in 1935, of the acreage as at 4th June under the principal varieties, together with the figures for 1934. The acreage accounted for here is 112,800 acres, the remaining 19,200 acres not being included in the returns of varieties. The finally revised figures of acreages under the different varieties of potatoes will be published as usual in October.

| | Acres | |
|---|---|---|
| | 1935 | 1934 |
| *First Earlies—* | | |
| Duke of York | 1,600 | 2,000 |
| Eclipse | 2,400 | 2,200 |
| Epicure | 8,800 | 9,000 |
| Sharpe's Express | 1,600 | 1,900 |
| Others | 1,800 | 1,500 |
| Totals | 16,200 | 16,600 |
| *Second Earlies—* | | |
| Ally | 200 | 300 |
| Great Scot | 8,000 | 9,300 |
| British Queen | 2,800 | 3,400 |
| Others | 1,700 | 1,600 |
| Totals | 12,700 | 14,600 |
| *Maincrops—* | | |
| Arran Banner | 2,700 | 2,800 |
| Doon Star | 1,700 | 700 |
| Golden Wonder | 8,900 | 9,100 |
| Kerr's Pink | 34,700 | 41,500 |
| Majestic | 14,700 | 14,000 |
| Arran Chief | 1,400 | 1,900 |
| King Edward VII | 14,700 | 16,500 |
| Others | 5,100 | 5,200 |
| Totals | 83,900 | 91,700 |

## CROPS AND GRASS

| DISTRIBUTION | 1935 | 1934 | INCREASE | | DECREASE | |
|---|---|---|---|---|---|---|
| | *Acres* | *Acres* | *Acres* | *Per Cent.* | *Acres* | *Per Cent.* |
| TOTAL AREA (excluding WATER) .. .. | 19,069,000 | 19,069,000 | .. | .. | .. | .. |
| TOTAL ACREAGE under all CROPS and GRASS (*a*) | 4,591,400 | 4,600,400 | .. | .. | 9,000 | 0·2 |
| ARABLE LAND .. .. .. .. .. | 2,975,300 | 2,991,600 | .. | .. | 16,300 | 0·5 |
| PERMANENT GRASS (*a*) { For Hay .. .. | 184,600 | 180,700 | 3,900 | 2·2 | .. | .. |
| PERMANENT GRASS (*a*) { Not for Hay.. .. | 1,431,500 | 1,428,100 | 3,400 | 0·2 | .. | .. |
| TOTAL .. | 1,616,100 | 1,608,800 | 7,300 | 0·5 | .. | .. |
| Wheat .. .. .. .. .. .. | 101,000 | 97,600 | 3,400 | 3·5 | .. | .. |
| Barley (including Bere) .. .. .. .. | 77,000 | 96,300 | .. | .. | 19,300 | 20·1 |
| Oats .. .. .. .. .. .. | 826,000 | 816,500 | 9,500 | 1·2 | .. | .. |
| Mixed Grain .. .. .. .. .. | 2,300 | 2,100 | 200 | 9·5 | .. | .. |
| Rye .. .. .. .. .. .. | 2,800 | 2,700 | 100 | 3·7 | .. | .. |
| Beans .. .. .. .. .. .. | 2,900 | 2,600 | 300 | 11·5 | .. | .. |
| Peas .. .. .. .. .. .. | 700 | 500 | 200 | 40·0 | .. | .. |
| Potatoes .. .. .. .. .. .. | 132,000 | 140,000 | .. | .. | 8,000 | 5·7 |
| Turnips and Swedes .. .. .. .. | 351,500 | 353,900 | .. | .. | 2,400 | 0·7 |
| Mangolds .. .. .. .. .. .. | 2,500 | 1,700 | 800 | 47·1 | .. | .. |
| Sugar Beet .. .. .. .. .. | 7,400 | 7,500 | .. | .. | 100 | 1·3 |
| Cabbage .. .. .. .. .. .. | 6,200 | 5,600 | 600 | 10·7 | .. | .. |
| Rape .. .. .. .. .. .. | 10,800 | 10,100 | 700 | 6·9 | .. | .. |
| Vetches, Tares, Mashlum, etc., for Fodder .. | 7,100 | 8,200 | .. | .. | 1,100 | 13·4 |
| Small Fruit .. .. .. .. .. | 9,600 | 9,600 | .. | .. | .. | .. |
| RYE-GRASS AND OTHER ROTATION GRASSES AND CLOVER { For Hay .. | 394,800 | 393,800 | 1,000 | 0·3 | .. | .. |
| RYE-GRASS AND OTHER ROTATION GRASSES AND CLOVER { Not for Hay | 1,018,800 | 1,023,000 | .. | .. | 4,200 | 0·4 |
| TOTAL .. | 1,413,600 | 1,416,800 | .. | .. | 3,200 | 0·2 |
| OTHER CROPS .. .. .. .. .. | 8,000 | 7,100 | 900 | 12·7 | .. | .. |
| BARE FALLOW .. .. .. .. .. | 13,900 | 12,800 | 1,100 | 8·6 | .. | .. |

## LIVE STOCK

| | *No.* | *No.* | *No* | *Per Cent.* | *No.* | *Per Cent.* |
|---|---|---|---|---|---|---|
| Horses used for Agricultural Purposes (including Mares for Breeding) .. .. .. | 110,500 | 112,000 | .. | .. | 1,500 | 1·3 |
| Unbroken Horses (including Stallions) { One year and above | 16,000 | 15,000 | 1,000 | 6·7 | .. | .. |
| Unbroken Horses (including Stallions) { Under one year .. | 6,100 | 6,000 | 100 | 1·7 | .. | .. |
| TOTAL .. | 132,600 | 133,000 | .. | .. | 400 | 0·3 |
| Other Horses .. .. .. .. .. | 14,500 | 15,000 | .. | .. | 500 | 3·3 |
| TOTAL OF HORSES .. | 147,100 | 148,000 | .. | .. | 900 | 0·6 |
| Cows in Milk .. .. .. .. .. | 369,900 | 368,900 | 1,000 | 0·3 | .. | .. |
| Cows in Calf, but not in Milk .. .. .. | 55,600 | 55,400 | 200 | 0·4 | .. | .. |
| Heifers in Calf .. .. .. .. .. | 70,200 | 71,900 | .. | .. | 1,700 | 2·4 |
| Bulls being used for Service .. .. .. | 17,800 | 17,600 | 200 | 1·1 | .. | .. |
| Other Cattle :—Two years and above .. .. | 195,200 | 192,300 | 2,900 | 1·5 | .. | .. |
| ,, ,, One year and under two .. | 328,300 | 324,400 | 3,900 | 1·2 | .. | .. |
| ,, ,, Under one year .. .. | 279,000 | 282,700 | .. | .. | 3,700 | 1·3 |
| TOTAL OF CATTLE .. | 1,316,000 | 1,313,200 | 2,800 | 0·2 | .. | .. |
| Ewes kept for Breeding .. .. .. .. | 3,334,000 | 3,354,000 | .. | .. | 20,000 | 0·6 |
| Rams to be used for Service .. .. | 95,800 | 97,000 | .. | .. | 1,200 | 1·2 |
| Other Sheep :—One year and above .. .. | 938,000 | 924,000 | 14,000 | 1·5 | .. | .. |
| ,, ,, Under one year .. .. | 3,388,000 | 3,280,000 | 108,000 | 3·3 | .. | .. |
| TOTAL OF SHEEP .. | 7,755,800 | 7,655,000 | 100,800 | 1·3 | .. | .. |
| Sows kept for Breeding .. .. .. .. | 32,500 | 28,300 | 4,200 | 14·8 | .. | .. |
| Boars being used for Service .. .. .. | 3,000 | 2,800 | 200 | 7·1 | .. | .. |
| Other Pigs .. .. .. .. .. | 220,000 | 175,200 | 44,800 | 25·6 | .. | .. |
| TOTAL OF PIGS .. .. | 255,500 | 206,300 | 49,200 | 23·8 | .. | .. |

(*a*) Excluding Mountain and Heath Land used for grazing.
(*b*) The figures for 1935 are subject to revision.

# Agricultural Conditions

DURING the first two weeks of June wet and cold conditions prevailed in most eastern and central districts ; in the west and south-west the rainfall was light but temperatures were low. Throughout the latter half of the month warmer weather was accompanied by abundant rain in all parts of the country and growth, which had been checked for several weeks, was rapid. Thunder showers were frequent in several central and south-western areas. Crops did not make average development for June in Ayr and North-East Fife, but in practically all districts pastures made excellent progress and at the end of the month live stock were thriving well. During July dry, sunny and warm weather prevailed, conditions being ideal for hay-making and the cleaning of root crops. Vegetation of all kinds made rapid growth and an early grain harvest was anticipated. Great progress was made in all kinds of farm work which was well forward for the season. In several districts, however, prolonged drought was beginning to tell on crops (especially potatoes and roots) and grass. During the first three weeks of August the weather was generally warm and dry, and following on the dry conditions prevailing during July this caused in some cases too early ripening. When rain fell over most of the country during the last week of the month potatoes, root crops and pastures benefited, while harvesting operations were somewhat delayed.

Wheat generally made good recovery in June from the adverse weather during May and by the end of the month the crop generally showed vigorous and healthy growth. In North-East Angus, however, it was rather backward, in parts of Berwick and Dumbarton plants were somewhat thin in places, while in North-East Fife and Central Perth the crop lacked the colour of other cereals. Charlock appeared to be more widespread than usual in the Lothians and Peebles. Lack of moisture, hot sunshine and drying winds during July caused premature ripening in all grain crops, but wheat withstood the dry conditions better than others. Harvesting was completed in many districts by the end of August. The crop proved to be of excellent quality and rather over the average in yield. In only four districts where the crop is grown was the yield expected to be below the normal. In Inverness and Nairn the total produce is expected to exceed the average by 15 per cent, in Lower Moray, North-East Fife, Stirling and Dumfries by 10 per cent, and in seven other districts by 5 per cent, while elsewhere an average yield is anticipated.

Barley showed vigorous and healthy growth at the end of June in most districts. In a few eastern areas, however, plants were rather backward, while in North Argyll the crop was thin in places. The crop made steady progress during July and by the end of the month was ripening fast in many districts. Some lodging was caused by heavy rains in Lower Moray and South-West Angus, and in Roxburgh the crop was in many cases badly twisted. By the end of August the crop had in most districts been cut and harvested in satisfactory condition. In South-East Perth later crops became badly lodged owing to copious rains and reaping was a tedious operation. Estimates of the probable yield indicate that in five districts a yield of about 5 per cent below the average is anticipated and in eight districts a yield of 5 per cent above the normal, while in North-East Fife and Inverness and Nairn a yield 10 per cent above the average is expected.

Oats responded well to the mild and moist conditions during the latter half of June and at the end of the month showed vigorous growth. In the south-west, however, the crop varied somewhat and on lighter soils in a few other areas plants were rather below normal in growth. Yarr and charlock were very prevalent in several eastern and north-eastern districts. The crop generally did not appear to thrive quite so well during July as the other cereals. Lea crops made good progress, but those following green crops made rather poor growth. No damage by insect pests was reported. In a few districts oats were rather deficient in straw, but by the end of August the crop generally had made good progress. In some areas, especially on light land and in the higher districts, oats ripened off rather quickly. The crop had been practically all cut throughout the country by the end of August and in several cases part of it had by then been stacked in good order. Estimates of the probable yield show that in eleven districts this year's production will be below the average by about 5 per cent, in Zetland, Dumbarton and North Ayr by 10 per cent. In ten districts an average yield is anticipated. In Central Perth a yield of 20 per cent above the normal is expected, in five other areas 10 per cent above and in thirteen districts 5 per cent above.

By the end of July beans were a strong and healthy crop. Plants podded well and good yields were expected. In South-East Perth straw was short and in North Ayr the crop was slow in drying and hardening. Estimates of production show that in North-East Banff and North-East Fife the yield is expected to exceed the normal by about 10 per cent. In eight districts the yield will be about average, while in the remaining districts where the crop is grown the yield will be below normal, in North Ayr by 15 per cent and in Stirling by 30 per cent.

As a result of frosts and dry weather during May, the growth of early potatoes was later than usual by two or three weeks. Late varieties did not suffer so much and by the end of June were showing strong and healthy growth. The weather during July was generally beneficial, although in a few districts the land was becoming very dry and growth was retarded owing to lack of rain. In Dumfries some blight on early varieties was reported. In South Ayr the early crop was well below normal, while in Kincardine the potato fields appeared to be very irregular and a lower yield was anticipated. The long-continued spell of dry weather retarded the growth of tubers in most districts and the rain at the end of August came too late to increase their bulk, many fields being too ripe to benefit. Blight was reported in Orkney, Zetland, Lewis and the Cowal district of Argyll, while a disease affecting the shaws, and in some varieties the tubers, was found in North Ayr. The yield is expected to be above the average by about 10 per cent in North-East Banff and North Argyll, by about 5 per cent in Skye, Islay and Jura, normal in seventeen districts and below the average in the remaining twenty districts, a deficiency of from 20 to 25 per cent being estimated in North Ayr, Kincardine, South-East Perth and Berwick.

By the end of June turnips and swedes were growing well in most counties. Plants came quickly to the hoe but in the east the work of thinning was considerably retarded by wet weather. In South-West Angus wild pigeons caused damage in newly-thinned fields ; wireworm was prevalent in Kirkcudbright and turnip fly in Inverness and Nairn. Where sown early the crop maintained fairly steady growth, but in the case of later sown turnips or where resowing was necessary the condition of the crop was below the average at the end of July. Rain was needed in many districts, particularly where turnips were sown late on stiff land. Finger and toe was prevalent in several areas, while in North and East Perth a maggot worm was attacking the crop on some farms. In Roxburgh an unclassified crown disease in some districts made resowing necessary. With the coming of rain during the second half of the month of August growth was much improved and the crop generally by the end of the month was strong and well-rooted. Finger and toe appeared in several areas and some mildew was reported. In South Ayr, Kirkcudbright and Wigtown, the crop suffered severely from the drought. Estimates of the yield of turnips and swedes show that in Stirling the produce will bulk 20 per cent above normal, in North-East Banff 15 per cent and in nine other districts from 5 to 10 per cent above. In eight districts the yield is expected to be about normal and in twelve districts 5 per cent below normal. In South-East Perth and the Lothians the deficiency is estimated at 10 per cent, in South-West Angus and Dumbarton 15 per cent, in North Ayr and Kirkcudbright 20 per cent, and in South Ayr 25 per cent.

Mangolds benefited greatly by the moisture and greater warmth during the latter half of June and were generally in average condition by the end of the month. During July and August plants made steady progress and the prospects of the crop were good. The development of sugar beet was retarded by the lack of heat and moisture during the early stages of growth and at the end of June the condition of the crop was only moderate in most districts where it is grown. In many fields in South-East Perth the plants were almost smothered by soft weeds, while in Central Perth the crop attracted rabbits which caused some damage. During July plants generally made good progress although suffering to some extent from lack of moisture, and strong and vigorous growth was maintained during August. " Bolters " were more prevalent than usual in some areas, but on the whole the crop promised well. The cutting of hay was delayed by the pressure of turnip-singling and the hope of a continuance of the rapid growth of grass in late June, and was not generally begun until July. Clover appeared to be more abundant than usual in the east and north-east, but in most western and south-western areas the mixture was not quite so good. Ideal weather for the harvesting of hay prevailed throughout July in most districts and the crop had in many cases been stacked in excellent condition by the end of the month. Dry weather enabled the harvesting to be carried through quickly and in several areas heavier crops than usual were gathered in. Estimates of the yield of hay from rotation grass indicate that in East Aberdeen and Central Perth the crop is above the average by 20 per cent, in North-East Fife by from 10 to 15 per cent, in four other districts by 10 per cent, and in five districts by 5 per cent. In North Argyll a large deficiency is anticipated in four other districts, one of 10 per cent and in sixteen areas one of 5 per cent, but elsewhere an average crop is expected. In Central Perth the yield of meadow hay will probably exceed the average by 20 per cent, in two other districts by about 10 per cent and in eight others by 5 per cent. Seventeen reports forecast an average yield, six one of 5 per cent and four one of 10 per cent, while in Wigtown the crop is expected to be lighter by 15 per cent and in the Lothians and Peebles by 20 per cent.

Heat and moisture came too late in June to cause any considerable improvement in the prospects for fruit, which suffered considerable damage in most areas from the frost in May. Strawberries were not so seriously affected as raspberries, which in some parts were very badly affected, while in others they suffered less. Currants and gooseberries were lighter crops than usual. Orchard fruits suffered more from the weather than did small fruits ; much of the blossom was frosted in May and as a result very small yields were secured. In North-West Lanark apples and pears were a small crop and plums a failure. In North and East Perth dry weather during the picking season reduced the raspberry crop by from 5 to 10 per cent.

In North-East Angus and Kintyre and Bute the fruit crop by the end of August was better than at first anticipated. In several areas, while the yield was much below normal, the condition of fruit generally was good.

Grass made rapid growth during the last two weeks of June and live stock benefited accordingly. Grazing cattle made good progress, but flies were troublesome, owing to the heat. Dairy cows throve well during June and July and the milk yield was generally normal, but in a few districts, owing to the effect of the dry weather on the grass, normal supplies were not maintained in July. During August hand-feeding had to be resorted to in North-East Fife, North Ayr and South-West Angus, while in Wigtown and Kincardine the condition of dairy cows by the end of the month was said to be only fair. The milk yield was below normal during August in several districts owing to scarcity of both grass and water. Maggot flies were troublesome among sheep in several areas. Foot trouble among lambs on low land was prevalent in Berwick and in Roxburgh, and Selkirk lambs showed a tendency to scour. Progress generally among sheep was satisfactory, although on hard hill land where grazings had suffered from lack of rainfall lambs did not thrive well.

Stocks of bees were generally reported to be healthy and in most cases yields were up to or above the average. In Lower Moray and North and East Perth clover honey was remarkably good and heavy returns were reported. Earlier in the season diseases were very prevalent in the Sutherland area and in Central Perth Isle of Wight disease was reported.

In several areas, particularly in the north-east and south-east, some difficulty was experienced during June in obtaining casual workers for turnip-hoeing, dairy workers and women continued to be inadequate for requirements in Renfrew, but otherwise the supply of workers in most districts was sufficient. In almost every district all available agricultural workers had been engaged at harvest time and there was no unemployment among them. Indeed men for the harvest were scarce in East and North-East Aberdeen, North-East Angus and Central Perth.

# STATISTICS

## PRICES OF AGRICULTURAL PRODUCE, FEEDING STUFFS AND FERTILISERS IN JUNE, JULY AND AUGUST 1935

### LIVE STOCK : Monthly Averages of Prices at certain representative Scottish Markets.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | JUNE | | | JULY | | | AUGUST | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality |
| FAT STOCK :— | | | | | | | | | |
| *CATTLE— | per cwt.<br>s. d. | per cwt.<br>s. d. | per cwt.<br>s. d. | per cwt.<br>s. d. | per cwt.<br>s. d. | per cwt.<br>s. d. | per cwt.<br>s. d. | per cwt.<br>s. d. | per cwt.<br>s. d. |
| Aberdeen-Angus .. | 45 1 | 41 0 | 37 8 | 46 1 | 41 10 | 38 4 | 43 6 | 39 7 | 37 0 |
| Cross-bred (Shorthorn) | 41 10 | 37 11 | 30 6 | 42 5 | 38 1 | 29 11 | 39 10 | 35 8 | 29 6 |
| Galloway .. .. | 40 8 | 37 2 | .. | 38 10 | 36 7 | .. | 35 11 | 33 8 | .. |
| Ayrshire .. .. | 38 6 | 35 3 | .. | 38 10 | 34 10 | .. | 37 7 | 34 5 | .. |
| Blue Grey .. .. | 44 6 | 42 0 | 40 0 | 43 5 | 41 4 | 40 0 | 42 2 | 39 8 | 39 4 |
| Highland .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | per lb.<br>d. | per lb.<br>d. | per lb.<br>d. | per lb.<br>d. | per lb.<br>d. | per lb.<br>d. | per lb.<br>d. | per lb.<br>d. | per lb.<br>d. |
| †VEAL CALVES .. .. | 12¼ | 3¾ | .. | 11½ | 4½ | .. | 11 | 4 | .. |
| †SHEEP— | Hoggs under 60 lb. per lb.<br>d. | 60 lb. and upw'd. per lb.<br>d. | Ewes per lb.<br>d. | Hoggs under 60 lb. per lb.<br>d. | 60 lb. and upw'd. per lb.<br>d. | Ewes per lb.<br>d. | Hoggs under 60 lb. per lb.<br>d. | 60 lb. and upw'd. per lb.<br>d. | Ewes per lb.<br>d. |
| Cheviot .. .. | 10½ | 10¼ | 7¼ | 10½ | .. | 7 | 10 | .. | 6¾ |
| Half-bred .. .. | 10½ | 9¾ | 7¼ | 10¼ | 9¼ | 7 | 10 | 9 | 6¾ |
| Blackface .. .. | 10¼ | 9½ | 7 | 10¼ | 9½ | 6¾ | 10 | 9 | 6¼ |
| Greyface .. .. | 10¼ | 10 | 7 | 10¼ | 9¾ | 7 | 9¾ | 9¼ | 6½ |
| Down Cross .. .. | 11 | 9¾ | 8 | 11 | 9½ | 8 | 10¾ | 9 | 7½ |
| †PIGS— | per stone<br>s. d. | per stone<br>s. d. | per stone<br>s. d. | per stone<br>s. d. | per stone<br>s. d. | per stone<br>s. d. | per stone<br>s. d. | per stone<br>s. d. | per stone<br>s. d. |
| Bacon Pigs .. .. | 8 6 | 7 5 | .. | 8 2 | 7 2 | .. | 8 2 | 7 3 | .. |
| Porkers .. .. | 9 3 | 8 1 | .. | 8 10 | 7 10 | .. | 8 8 | 7 9 | .. |

* Live weight. † Estimated dressed carcase weight.

## Live Stock : Monthly Averages of Prices (per head) at certain representative Scottish Markets—(*continued*).

| Description | June | | | July | | | August | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality | 1st Quality | 2nd Quality | 3rd Quality |
| **STORE STOCK :—** | | | | | | | | | |
| **Cattle—** | | | | | | | | | |
| Aberdeen-Angus: | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. |
| Yearlings .. .. | 14 8 | 11 12 | 9 3 | 14 8 | 11 10 | 9 7 | 13 15 | 11 0 | 8 12 |
| Two-year-olds .. | 18 6 | 14 19 | 11 3 | 17 17 | 14 16 | 11 18 | 17 13 | 14 10 | .. |
| Cross-bred (Shorthorn) | | | | | | | | | |
| Yearlings .. .. | 13 14 | 10 12 | 7 15 | 13 16 | 10 14 | 8 18 | 12 18 | 9 12 | .. |
| Two-year-olds .. | 17 2 | 14 1 | 10 6 | 17 11 | 14 11 | 12 10 | 16 9 | 13 13 | 11 14 |
| Galloway : | | | | | | | | | |
| Yearlings .. .. | 13 5 | 10 4 | .. | 12 11 | 10 0 | .. | 12 17 | 10 0 | .. |
| Two-year-olds .. | 17 0 | .. | .. | .. | 14 3 | .. | .. | .. | .. |
| Ayrshire : | | | | | | | | | |
| Yearlings .. .. | 10 16 | .. | .. | 11 7 | .. | .. | .. | .. | .. |
| Two-year-olds .. | 17 15 | .. | .. | .. | .. | .. | .. | .. | .. |
| Blue Grey : | | | | | | | | | |
| Yearlings .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Two-year-olds .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Highland : | | | | | | | | | |
| Yearlings .. .. | 7 18 | 6 13 | .. | 8 0 | 5 13 | .. | .. | .. | .. |
| Two-year-olds .. | .. | 9 14 | .. | .. | 10 3 | .. | .. | .. | .. |
| Three-year-olds .. | .. | 11 10 | .. | .. | .. | .. | .. | .. | .. |
| **Dairy Cows—** | | | | | | | | | |
| Ayrshire : | | | | | | | | | |
| In milk .. .. | 24 9 | 18 0 | 12 18 | 25 15 | 18 13 | 13 5 | 25 8 | 18 16 | 13 8 |
| Calvers .. .. | 25 4 | 19 14 | 14 9 | 25 16 | 19 14 | 14 11 | 26 12 | 19 15 | 14 10 |
| Shorthorn Cross : | | | | | | | | | |
| In milk .. .. | 24 16 | 17 17 | 16 8 | 25 13 | 18 3 | 16 8 | 25 19 | 18 16 | 17 1 |
| Calvers .. .. | 23 9 | 16 14 | 14 0 | 24 16 | 17 1 | 15 1 | 25 12 | 17 19 | 15 13 |
| **Sheep—** | *s. d.* | *s. d.* | *s. d.* | *s. d.* | *s. d.* | *s. d.* | *s. d.* | *s. d.* | *s. d.* |
| Cheviot Hoggs .. | 33 0 | .. | .. | .. | .. | .. | .. | .. | .. |
| Half-bred Hoggs .. | 44 1 | 31 4 | .. | 45 9 | 36 0 | .. | .. | .. | .. |
| Blackface Hoggs .. | 24 3 | 18 3 | .. | 31 5 | 24 4 | .. | .. | .. | .. |
| Greyface Hoggs .. | 36 5 | 28 5 | .. | 38 9 | 32 6 | .. | .. | .. | .. |
| Down Cross Hoggs | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **Pigs—** | | | | | | | | | |
| (6 to 10 weeks old) | 29 4 | 18 2 | .. | 28 2 | 18 4 | .. | 28 3 | 18 11 | .. |

## DEAD MEAT : Monthly Average Prices at Dundee, Edinburgh and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | QUALITY | JUNE | | | JULY | | | AUGUST | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Dundee | Edinburgh | Glasgow | Dundee | Edinburgh | Glasgow | Dundee | Edinburgh | Glasgow |
| **BEEF** :— | | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* | per lb.<br>*d.* |
| Home-fed— | | | | | | | | | | |
| Bullock or Heifer .. | 1 | 6⅞ | 6⅝ | 8 | 7 | 7 | 8⅛ | 6¾ | 6⅜ | 7⅞ |
| | 2 | 6⅜ | .. | 6¾ | 6⅝ | .. | 7 | 6⅜ | .. | 7 |
| Bull .. .. .. | 1 | 5⅝ | 5 | 5½ | 5¾ | 4¾ | 5⅛ | 5½ | 4⅝ | 5 |
| | 2 | 4⅝ | .. | 4½ | 5 | .. | 4½ | 5 | .. | 4 |
| Cow .. .. .. | 1 | 4⅞ | 4⅞ | 5 | 4⅞ | 4¾ | 5 | 4½ | 4⅝ | 4½ |
| | 2 | 4 | .. | 4 | 4¼ | .. | 4 | 4 | .. | 4 |
| Irish— | | | | | | | | | | |
| Bullock or Heifer .. | 1 | .. | .. | 7¼ | .. | .. | 7½ | .. | .. | 6⅞ |
| | 2 | .. | .. | 6 | .. | .. | 6⅜ | .. | .. | 5⅞ |
| Argentine Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | 4⅝ | 4⅝ | .. | 4⅜ | 4 | .. | 4⅛ | 4½ | .. |
| | 2 | .. | 4¼ | .. | .. | 3½ | .. | .. | 3⅝ | .. |
| Fore ,, .. | 1 | 3¾ | 4 | .. | 3½ | 3½ | .. | 3⅛ | 3⅝ | .. |
| | 2 | .. | 3½ | .. | .. | 2⅞ | .. | .. | 3 | .. |
| Argentine Chilled— | | | | | | | | | | |
| Hind Quarters .. | 1 | 6⅛ | 6¼ | 6 | 6 | 5⅞ | 5⅛ | 6⅛ | 6¼ | 5½ |
| | 2 | .. | 5⅝ | 5⅛ | .. | 5¼ | 4½ | .. | 5¾ | 4¾ |
| Fore ,, .. | 1 | 3⅞ | 3⅞ | 3⅝ | 3¾ | 3⅜ | 2¾ | 3½ | 3¼ | 2¾ |
| | 2 | .. | 3½ | 3½ | .. | 2⅞ | 2½ | .. | 2¾ | 2½ |
| Australian Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | .. | .. | 4 | .. | .. | 3⅞ | .. | .. | 3½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Crops .. .. | 1 | .. | .. | 3⅜ | .. | .. | 3¼ | .. | .. | 2⅝ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| New Zealand Frozen— | | | | | | | | | | |
| Hind Quarters .. | 1 | .. | .. | 4 | .. | .. | 3⅞ | .. | .. | 3½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Fore ,, .. | 1 | .. | .. | 3⅛ | .. | .. | 3 | .. | .. | 2½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **MUTTON** :— | | | | | | | | | | |
| Hoggs, Blackface .. | under 60 lb. | 10 | 10⅛ | 9⅝ | 9¾ | 9¼ | 9⅝ | 9¼ | 8 | 8⅝ |
| | 60 lb. & over | 9⅛ | .. | 9¼ | 9¼ | .. | 9⅛ | 8⅝ | .. | 8 |
| ,, Cross .. | under 60 lb. | 10 | 10⅛ | 9⅝ | 9¾ | 9¼ | 9⅝ | 9 | 8 | 8⅝ |
| | 60 lb. & over | 9⅛ | .. | 9¼ | 9¼ | .. | 9⅛ | 8⅜ | .. | 8 |
| Ewes, Cheviot .. | 1 | .. | 6¾ | 7⅜ | .. | 6⅛ | 7⅜ | .. | 5¼ | 6¼ |
| | 2 | .. | .. | 7 | .. | .. | 6¾ | .. | .. | 5¾ |
| ,, Blackface .. | 1 | 8 | 6¾ | 7⅜ | 7¾ | 6⅛ | 7⅜ | 7 | 5¼ | 6¼ |
| | 2 | 7½ | .. | 7 | 7¼ | .. | 6¾ | 6⅛ | .. | 5¾ |
| ,, Cross .. .. | 1 | 6 | 6¾ | 7⅜ | 5⅞ | 6⅛ | 7⅜ | 5⅜ | 5¼ | 6¼ |
| | 2 | 5 | .. | 7 | 5 | .. | 6¾ | 4¼ | .. | 5¾ |
| Argentine Frozen .. | 1 | .. | .. | 3½ | .. | .. | 3⅜ | .. | 5 | 3 |
| | 2 | .. | .. | .. | .. | .. | .. | .. | 3⅞ | .. |
| Australian ,, .. | 1 | .. | 4½ | 3½ | .. | 4½ | 3⅜ | .. | .. | 3 |
| | 2 | .. | 3¼ | .. | .. | 3 | .. | .. | .. | .. |
| New Zealand ,, .. | 1 | .. | .. | 3¾ | .. | .. | 3¾ | .. | .. | 4½ |
| | 2 | .. | .. | 3¼ | .. | .. | 3⅛ | .. | .. | 2¾ |
| **LAMB** :— | | | | | | | | | | |
| Home-fed .. .. | 1 | 11¾ | 11¾ | 11½ | 10½ | 10¾ | 11¼ | 9½ | 9⅛ | 9½ |
| | 2 | .. | .. | 11 | 10 | .. | 10¾ | 9 | .. | 9 |
| New Zealand Frozen | 1 | .. | 7½ | 7 | .. | 7⅝ | 7⅛ | .. | 7⅞ | 7¼ |
| | 2 | .. | 7 | .. | .. | 7¼ | .. | .. | 7½ | .. |
| Australian ,, .. | 1 | .. | .. | 5¾ | .. | .. | 5⅞ | .. | .. | 6½ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Argentine ,, .. | 1 | .. | .. | 5½ | .. | .. | 5¾ | .. | .. | 5⅞ |
| | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **PORK** :— | | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* | *per cwt.*<br>*s. d.* |
| Home-fed .. .. | 1 | 73 6 | 68 3 | 78 2 | 70 0 | 65 4 | 74 8 | 70 0 | 64 2 | 74 8 |
| | 2 | 37 4 | .. | 70 0 | 37 4 | .. | 70 0 | 37 4 | .. | 70 0 |
| Imported .. .. | 1 | .. | .. | 59 6 | .. | .. | 56 0 | .. | .. | 56 0 |

## EGGS: Monthly Average Wholesale Prices at Aberdeen, Kilmarnock, Lanarkshire and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | WEIGHT PER 120 | QUALITY | JUNE | JULY | AUGUST |
|---|---|---|---|---|---|
| | *lb.* | | *s. d.* | *s. d.* | *s. d.* |
| **ABERDEEN—** | | | | | |
| Country (ungraded) per doz. | .. | 1 | 0 11 | 0 11¼ | 1 3¼ |
| | .. | 2 | 0 10½ | .. | .. |
| **KILMARNOCK—** | | | | | |
| Country (ungraded) per doz. | .. | 1 | 1 2 | 1 0½ | 1 5½ |
| **LANARKSHIRE—** | | | | | |
| Country "Standard" per doz. | .. | 1 | 1 3 | 1 2¾ | 1 7¼ |
| **GLASGOW—** | | | | | |
| National Mark— | | | | | |
| "Special" .. per doz. | .. | .. | 1 2¾ | 1 3½ | 1 8 |
| "Standard" .. ,, | .. | .. | 1 1¾ | 1 2¼ | 1 6¾ |
| "Medium" .. ,, | .. | .. | 1 0½ | 1 1 | 1 5¼ |
| "Ungraded" .. ,, | .. | 1 | 1 0½ | 1 2 | 1 6¾ |
| "Special" .. per 120 | .. | .. | 11 6 | 12 4 | 15 10 |
| "Standard" .. ,, | .. | .. | 10 6 | 11 5 | 14 11 |
| "Medium" .. ,, | .. | .. | 9 5 | 10 2 | 13 4 |
| "Ungraded" .. ,, | .. | 1 | 9 9 | 11 8 | 14 6 |
| Northern Ireland ,, | 17 | .. | 11 0 | 12 3 | 15 4 |
| ,, ,, | 15½ | .. | 10 1 | 11 5 | 14 5 |
| ,, ,, | 14 | .. | 8 10 | 10 3 | 12 9 |
| ,, Duck ,, | .. | 1 | 9 0 | 7 11 | 11 3 |
| Irish Free State .. ,, | 16 | .. | 9 1 | 9 8 | 13 8 |
| ,, .. ,, | 15 | .. | 8 7 | 9 3 | 12 11 |
| ,, .. ,, | 14 | .. | 7 10 | 8 8 | 11 8 |
| ,, Duck .. ,, | .. | 1 | 8 6 | 7 2 | 11 0 |
| Irish Free State Cold Stored— | | | | | |
| "Extra" .. per 120 | .. | .. | .. | .. | 10 5 |
| "Selected" .. ,, | .. | .. | .. | .. | 10 1 |
| "Medium" .. ,, | .. | .. | .. | .. | 9 4 |
| Danish .. .. ,, | 15½ | .. | 9 1 | 9 10 | 12 1 |
| ,, .. .. ,, | 14 | .. | 8 4 | 9 1 | 11 1 |
| Swedish .. .. ,, | 15½ | .. | 8 7 | 9 8 | 11 11 |
| ,, .. .. ,, | 14 | .. | 8 0 | 8 10 | .. |
| Polish "Red" ,, | .. | .. | 5 7 | 6 4 | 7 0 |
| ,, "Blue" ,, | .. | .. | .. | 7 1 | 8 5 |

## PROVISIONS: Monthly Average Wholesale Prices (per cwt.) at Glasgow.

| DESCRIPTION | QUALITY | JUNE | JULY | AUGUST |
|---|---|---|---|---|
| | | *s. d.* | *s. d.* | *s. d.* |
| **BUTTER—** | | | | |
| Scottish Creamery .. .. | 1 | 106 6 | 108 0 | 116 0 |
| Irish Creamery .. .. .. | 1 | 89 0 | 92 0 | 102 3 |
| ,, (unsalted) .. | 1 | 93 0 | 94 7 | 104 3 |
| Australian .. .. .. | 1 | 88 3 | 92 2 | 99 0 |
| Danish .. .. .. | 1 | 102 6 | 106 0 | 112 9 |
| ,, (unsalted) .. .. | 1 | 106 0 | 107 10 | 114 9 |
| Dutch .. .. .. | 1 | 83 0 | 89 2 | 93 3 |
| New Zealand .. .. .. | 1 | 92 0 | 96 2 | 99 3 |
| ,, (unsalted) .. .. | 1 | 95 0 | 98 10 | 101 3 |
| Swedish .. .. .. | 1 | 91 6 | 93 10 | 102 6 |
| Latvian .. .. .. | 1 | 80 3 | 87 7 | 93 6 |
| **CHEESE—** | | | | |
| Cheddar .. .. .. .. | 1 | 60 0 | 60 0 | 57 0 |
| | 2 | 44 5 | 42 0 | 40 3 |
| Cheddar Loaf .. .. .. | 1 | 56 0 | 56 0 | 54 0 |
| | 2 | 44 0 | 44 0 | 44 3 |
| Dunlop .. .. .. | 1 | 65 0 | 64 0 | 60 6 |
| | 2 | 45 0 | 42 10 | 42 3 |
| Canadian .. .. .. | 1 | 64 0 | 60 10 | 60 0 |
| New Zealand (Coloured) .. | 1 | 48 0 | 49 0 | 50 3 |
| ,, (White) .. .. | 1 | 48 0 | 49 0 | 50 3 |
| **HAMS**—Irish (Smoked) .. .. | 1 | 172 0 | 172 7 | 172 0 |
| | 2 | 162 0 | 150 0 | 147 0 |
| American (Short Cut, Green) .. | 1 | 99 0 | 100 5 | 108 6 |
| Canadian (Long Cut, ,, ) .. | 1 | 100 3 | 104 0 | 111 0 |
| **BACON**—Ayrshire (Rolled) .. | 1 | 120 4 | 120 4 | 115 5 |
| English Wiltshire (Green) .. | 1 | 108 0 | 107 5 | 104 0 |
| ,, (Dried or Smoked) .. | 1 | 110 0 | 111 2 | 107 6 |
| Irish (Green, Wiltshire Style) .. | 1 | 104 0 | 102 10 | 95 6 |
| | 2 | 100 0 | 97 10 | 91 6 |
| ,, (Dried or Smoked) .. | 1 | 107 0 | 104 10 | 102 0 |
| | 2 | 102 0 | 99 10 | 96 6 |
| ,, (Long Clear) .. .. | 1 | 114 0 | 111 10 | 104 6 |
| | 2 | 112 0 | 109 10 | 102 6 |
| Canadian Sides (Green) .. | 1 | 93 0 | 92 7 | 88 0 |
| Danish Sides .. .. .. | 1 | 103 0 | 106 7 | 100 6 |
| Dutch (Green, Wiltshire Style) | 1 | 113 0 | 114 7 | 108 0 |
| **LARD**—American .. .. | 1 | 67 0 | 68 7 | 83 3 |

## FRUIT AND VEGETABLES : Monthly Average Wholesale Prices at Glasgow.

*(Compiled from Returns received from the Department's Market Reporter)*

| DESCRIPTION | | QUALITY | JUNE | JULY | AUGUST |
|---|---|---|---|---|---|
| **FRUIT :—** | | | | | |
| Apples— | per | | *s. d.* | *s. d.* | *s. d.* |
| British Cooking | 56 lbs. | 1 | .. | .. | 10 7 |
| American | case.* | 1 | .. | .. | 11 11 |
| Australian | „ * | 1 | 12 11 | 13 11 | 14 4 |
| Pears— | | | | | |
| Australian | „ † | 1 | .. | 20 0 | .. |
| Californian | „ † | 1 | .. | 18 6 | .. |
| Gooseberries | lb. | 1 | .. | 0 3 | 0 3¼ |
| Currants— | | | | | |
| Black | „ | 1 | .. | 0 8¾ | 0 9 |
| Red | „ | 1 | .. | 0 6 | 0 6½ |
| Greengages, Imported | „ | 1 | .. | 0 6¾ | 0 8 |
| Raspberries | „ | 1 | .. | 0 6¼ | 0 6 |
| Strawberries— | | | | | |
| Scottish | „ | 1 | .. | 1 1½ | 1 5 |
| English | „ | 1 | 0 10 | 0 11 | .. |
| Plums— | | | | | |
| Czar | „ | 1 | .. | .. | 0 4 |
| Victoria | „ | 1 | .. | .. | 0 6½ |
| **VEGETABLES :—** | | | | | |
| Beans, Dwarf | „ | 1 | .. | .. | 0 3 |
| Beet | dozen bunches. | 1 | ø4 6 | 4 2 | 3 6 |
| Cabbage— | | | | | |
| Coleworts | dozen. | 1 | 1 0 | 1 0 | 1 0 |
| Scottish | „ | 1 | .. | 1 5 | 1 6 |
| Carrots— | | | | | |
| English | cwt. | 1 | 6 0 | 8 4 | 10 0 |
| Dutch | „ | 1 | 5 6 | 12 0 | 9 0 |
| Cauliflowers | dozen. | 1 | 4 3 | 4 8 | 4 8 |
| Celery | bunch. | 1 | .. | 3 6 | 3 0 |
| Cucumbers | dozen. | 1 | 4 6 | 5 6 | 4 11 |
| Leeks | dozen bunches. | 1 | .. | .. | 3 2 |
| Lettuce, Cos | dozen. | 1 | .. | 1 2 | 1 3 |
| Cabbage | „ | 1 | 1 3 | 1 0 | 1 0 |
| Onions— | | | | | |
| *Spring* | bunch. | 1 | 0 5 | 0 4½ | 0 4 |
| *Egyptian* | cwt. | 1 | 9 2 | 7 1 | 6 2 |
| *Dutch* | bag.§ | 1 | .. | .. | 7 0 |
| *Valencia* | case.** | 1 | 9 8 | 8 1 | 8 3 |
| Parsley | cwt. | 1 | 9 6 | 14 10 | 28 0 |
| Peas | „ | 1 | 35 0 | 14 1 | 11 6 |
| Radishes | dozen bunches. | 1 | 1 2 | 1 3 | 1 5 |
| Rhubarb | cwt. | 1 | 2 0 | 3 0 | 5 0 |
| Spinach | stone. | 1 | 4 0 | 3 6 | 3 3 |
| Tomatoes— | | | | | |
| Scottish | lb. | 1 | 0 7¼ | 0 6¼ | 0 6¾ |
| Channel Islands | „ | 1 | 0 5¼ | 0 4¾ | 0 5½ |
| Dutch | „ | 1 | .. | .. | 0 4½ |
| Turnips | dozen bunches. | 1 | 3 2 | 3 5 | ø4 4 |
| Vegetable Marrow | dozen. | 1 | .. | .. | 4 0 |

* 40 lb. (approx.).
† 46 lb. (approx.).
ø per cwt.
§ 7½ stone (approx.).
** 9 stone (approx.).

## POTATOES : Monthly Average Wholesale Prices (per ton) at Aberdeen, Dundee, Edinburgh and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| MARKET | Quality | FIRST EARLIES | SECOND EARLIES | LATE VARIETIES | | | |
|---|---|---|---|---|---|---|---|
| | | | | RED SOILS | | OTHER SOILS | |
| | | | | Golden Wonder | Other | Golden Wonder | Other |
| | | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| | | JUNE | | | | | |
| Aberdeen .. | 1 | .. | .. | .. | .. | 6 6 3 | 5 3 9 |
| Dundee .. | 1 | 17 10 0 | .. | .. | .. | 6 8 9 | 4 12 6 |
| Edinburgh .. | 1 | 14 0 0 | .. | .. | .. | 7 3 4 | 7 3 4 |
| Glasgow .. | 1 | 18 0 0 | .. | .. | .. | 7 1 3 | 5 18 9 |
| | | JULY | | | | | |
| Aberdeen .. | 1 | 10 17 6 | .. | .. | .. | 6 0 0 | 5 0 0 |
| Dundee .. | 1 | 10 8 0 | .. | .. | .. | .. | .. |
| Edinburgh .. | 1 | 9 13 2 | .. | .. | .. | .. | .. |
| Glasgow .. | 1 | 10 1 4 | .. | .. | .. | 6 0 0 | 5 5 0 |
| | | AUGUST | | | | | |
| Aberdeen .. | 1 | 7 10 0 | 5 11 3 | .. | .. | .. | .. |
| Dundee .. | 1 | .. | 7 0 0 | .. | .. | .. | .. |
| Edinburgh .. | 1 | 7 5 0 | 6 16 3 | .. | .. | .. | .. |
| Glasgow .. | 1 | 6 16 8 | .. | .. | .. | .. | .. |

## ROOTS, HAY, STRAW, AND MOSS LITTER : Monthly Average Prices (per ton) at Aberdeen, Dundee, Edinburgh and Glasgow.

*(Compiled from Returns received from the Department's Market Reporters)*

| MARKET | Quality | ROOTS | | | HAY | | STRAW | | | MOSS LITTER |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Carrots | Yellow Turnips | Swedes | Ryegrass and Clover | Timothy | Wheat | Barley | Oat | |
| | | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| | | JUNE | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 70 0 | .. | .. | .. | 41 3 | .. |
| †Dundee .. | 1 | .. | .. | .. | 100 0*a*<br>90 0*b* | .. | 50 0 | .. | 65 0 | .. |
| ‖Edinburgh .. | 1 | .. | .. | .. | 85 0*a*<br>82 6*b* | .. | 27 6 | 22 6 | 30 0 | .. |
| *a*Glasgow .. | 1 | .. | .. | .. | 85 0 | 90 0 | 35 0 | .. | 50 0 | 34 9*c* |
| | | JULY | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 69 0 | .. | .. | .. | 36 0 | .. |
| †Dundee .. | 1 | .. | .. | .. | 100 0*a*<br>90 0*b* | .. | 49 0 | 50 0 | 62 0 | .. |
| ‖Edinburgh .. | 1 | .. | .. | .. | 84 0*a*<br>82 6*b* | .. | 27 6 | 22 6 | 30 0 | .. |
| *a*Glasgow .. | 1 | .. | .. | .. | 85 0 | 92 0 | 35 0 | .. | 50 0 | 34 9*c* |
| | | AUGUST | | | | | | | | |
| *Aberdeen .. | 1 | .. | .. | .. | 63 9 | .. | .. | .. | 35 0 | .. |
| †Dundee .. | 1 | .. | .. | .. | 95 0*a*<br>65 0*b* | .. | 45 0 | .. | 57 6 | .. |
| ‖Edinburgh .. | 1 | .. | .. | .. | 75 0*a*<br>71 3*b* | .. | 27 6 | 22 6 | 30 0 | .. |
| *a*Glasgow .. | 1 | .. | .. | .. | 83 9 | 91 11 | 35 0 | .. | 48 9 | 34 9*c* |

* Ex farm, loose.

† Baled straw, delivered in town.

‖ Bunched or baled straw, delivered.

*a* Baled and delivered.

*b* Delivered, loose.

c Home moss litter, in 1½-cwt. bales.

## FEEDING STUFFS: Monthly Average Prices (per ton) at Glasgow and Leith.

*(Compiled from Returns received from the Department's Market Reporters)*

| DESCRIPTION | JUNE | | JULY | | AUGUST | |
|---|---|---|---|---|---|---|
| | Glasgow | Leith | Glasgow | Leith | Glasgow | Leith |
| Linseed Cake— | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Home .. .. .. | 7 14 5 | 7 13 9 | 7 12 6 | 7 12 6 | 7 15 0 | 7 12 6 |
| Foreign .. .. .. | 7 6 7 | 7 0 0 | 7 2 6 | 6 17 8 | 7 1 11 | 6 17 6 |
| Undecort. Cotton Cake— | | | | | | |
| Egyptian (Home manufactured) .. .. | 4 12 6 | 4 12 6 | 4 16 6 | 4 16 0 | 5 1 11 | 4 18 9 |
| Palmnut Kernel Cake .. | 7 10 0 | .. | 7 5 0 | .. | 7 5 8 | .. |
| Soya Bean Cake .. .. | 8 0 0 | .. | 8 0 0 | .. | .. | .. |
| Coconut Cake .. .. | 7 12 6 | .. | 7 2 0 | .. | 6 19 8 | .. |
| Groundnut Cake, undecort.— | | | | | | |
| (50 % Oil and Album.) .. | .. | 7 5 0 | .. | 7 3 0 | .. | 7 0 0 |
| (54 % „ „ ) .. | 6 15 8 | .. | 6 13 6 | .. | 6 9 8 | .. |
| Maize Germ Cake, Home mfd. | 6 11 3 | .. | 6 18 6 | .. | 6 19 1 | .. |
| „ „ Meal .. .. | 5 11 7 | .. | 5 7 0 | .. | 5 0 11 | .. |
| Rice Meal .. .. .. | 5 4 5 | .. | 4 18 9 | 4 15 0 | 4 16 11 | 5 0 0 |
| Bean Meal .. .. .. | 8 17 6 | 8 11 3 | 8 16 0 | 8 10 0 | 8 16 11 | 8 7 6 |
| Barley Meal .. .. .. | 7 0 4 | 7 3 9 | 6 12 6 | 6 15 0 | 6 3 2 | 6 1 11 |
| Fish Meal .. .. .. | 13 15 0 | 13 15 0 | 13 10 0 | 13 15 0 | 13 12 6 | 13 15 0 |
| Maize Meal— | | | | | | |
| Home manufactured .. | 5 15 4 | 5 11 11 | 5 6 3 | 5 3 6 | 5 5 0 | 5 1 11 |
| South African, Yellow .. | 5 6 5 | 5 3 9 | 5 0 3 | 4 17 0 | 4 19 5 | 4 15 0 |
| „ „ White .. | 5 5 0 | .. | 4 17 6 | .. | .. | .. |
| Locust Bean Meal .. .. | 8 0 0 | 7 10 0 | 8 0 0 | 7 10 0 | 8 1 3 | 7 10 0 |
| Locust Beans (Kibbled and Stoned) .. .. .. | 7 10 4 | 7 10 0 | 7 7 6 | 7 10 0 | 7 9 5 | 7 10 0 |
| Maize Gluten Feed (Paisley) | 5 10 0 | .. | 5 10 0 | .. | 5 4 5 | .. |
| Maize— | | | | | | |
| Plate .. .. .. | 4 18 5 | 4 16 11 | 4 9 9 | 4 6 3 | 4 7 10 | 4 5 0 |
| African .. .. | 5 10 0 | .. | 5 3 9 | .. | 5 0 0 | .. |
| Oats— | | | | | | |
| Home .. .. .. | 7 9 8 | 7 14 5 | 7 8 3 | 7 8 9 | 7 4 5 | 7 3 9 |
| Canadian, No. 2 .. .. | .. | 7 3 9 | 7 6 8 | 7 1 0 | .. | 7 2 6 |
| „ „ 3 .. .. | 7 10 0 | .. | 7 10 0 | .. | 7 10 0 | .. |
| Barley— | | | | | | |
| Home .. .. .. | .. | 6 3 2 | .. | 5 19 6 | .. | .. |
| Imported .. .. .. | 6 1 3 | 5 14 5 | 5 13 6 | 5 4 1 | 5 6 11 | 4 15 0 |
| Wheat— | | | | | | |
| Home .. .. .. | 6 1 11 | 5 15 0 | 6 5 6 | 5 16 9 | 6 5 4 | 5 16 11 |
| „ (Poultry) .. .. | 5 16 11 | .. | 5 18 9 | .. | 6 0 8 | .. |
| Imported .. .. .. | 5 15 10 | 5 11 3 | 5 16 3 | 5 14 3 | 6 0 0 | 5 15 0 |
| Middlings (Fine Thirds or Parings) .. .. .. | 6 11 11 | 6 2 6 | 6 13 9 | 6 4 3 | 6 14 8 | 6 10 0 |
| Sharps (Common Thirds) | 5 16 3 | 5 3 2 | 5 16 3 | 5 8 0 | 6 0 4 | 5 11 11 |
| Bran (Medium) .. .. | 5 7 6 | 5 2 6 | 5 9 9 | 5 2 9 | 5 7 10 | 5 3 2 |
| „ (Broad) .. .. | 5 16 3 | 5 19 5 | 5 17 0 | 5 19 0 | 5 16 11 | 5 16 11 |
| Malt Culms .. .. .. | 5 14 5 | 5 0 0 | 5 16 3 | 5 5 0 | 5 16 7 | 5 5 0 |
| Distillers' Mixed Grains (Dried) | .. | 6 2 6 | .. | 6 7 0 | 6 3 9 | 6 5 0 |
| Brewers' Grains (Dried) .. | .. | 4 18 9 | 5 14 5 | 4 14 6 | 5 5 0 | 4 15 0 |
| Crushed Linseed .. .. | 15 10 0 | .. | 15 10 0 | .. | 15 11 3 | .. |
| Beans— | | | | | | |
| China .. .. .. | 7 18 2 | 8 0 0 | 7 17 0 | 7 18 4 | 7 18 9 | .. |
| Rangoon (White) .. .. | 6 5 10 | 6 13 6 | 6 3 2 | 6 15 0 | 5 19 5 | .. |
| „ (Red) .. .. | .. | 6 10 0 | .. | 6 10 0 | .. | .. |
| English .. .. .. | .. | 7 12 6 | .. | 7 10 6 | .. | 7 12 6 |
| Pease— | | | | | | |
| Calcutta (White) .. .. | 9 10 0 | .. | 9 12 6 | .. | 9 15 0 | .. |
| Karachi ( „ ) .. .. | 8 19 2 | .. | 9 0 0 | .. | 8 15 0 | .. |
| Feeding Treacle .. .. | 5 5 0 | 5 10 0 | 5 5 0 | 5 10 0 | 5 1 11 | 5 10 0 |
| Linseed Oil, per gall. .. | 0 4 0 | .. | 0 4 0 | .. | 0 4 0 | .. |

## FERTILISERS: Monthly Average Prices (per ton) at Glasgow and Leith.

*(Compiled from Returns received from the Department's Market Reporters)*

| Description | Guaranteed Analysis | June | | July | | August | |
|---|---|---|---|---|---|---|---|
| | | Glasgow | Leith | Glasgow | Leith | Glasgow | Leith |
| | % | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Nitrate of Soda * | N. 15·5 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 | 7 12 6 |
| Sulphate of Ammonia (Neutral and Granular) * .. | N. 20·6 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 | 6 17 2 | 7 5 0 |
| Calcium Cyanamide † | N. 20·6 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 | 6 17 6 | 7 5 0 |
| Nitrochalk * .. | N. 15·5 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 | 7 5 0 |
| Nitrate of Lime .. | N. 15·5 | .. | 7 10 0 | .. | 7 10 0 | .. | 7 10 0 |
| Superphosphate .. | P.A. 13·7 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 |
| „ .. | „ 16·0 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 |
| „ .. | „ 18·3 | 3 2 6 | 3 2 6 | 3 2 6 | 3 2 6 | 3 2 6 | 3 2 6 |
| Ground Mineral Phosphate § .. | P.A. 27·5 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 | 2 12 6 |
| „ „ „ § .. | „ 34 | 3 10 0 | 3 10 0 | 3 10 0 | 3 10 0 | 3 10 0 | 3 10 0 |
| Potassic Mineral Phosphate | P.A. 18<br>Pot. 10 | 3 10 0 | .. | 3 10 0 | .. | 3 11 11 | .. |
| „ „ „ | P.A. 18<br>Pot. 9 | .. | 3 5 0 | .. | 3 5 0 | .. | 3 5 0 |
| „ „ „ | P.A. 20<br>Pot. 7.5 | 3 5 0 | .. | 3 5 0 | .. | 3 6 11 | .. |
| Kainit (in bags) .. | Pot. 14 | 3 0 0 | 2 17 6 | 3 0 0 | 2 17 6 | 3 0 10 | 2 17 6 |
| Potash Salts .. | Pot. 20 | 3 15 0 | 3 10 0 | 3 15 0 | 3 10 0 | 3 19 2 | 3 10 0 |
| „ „ .. | „ 30 | 4 10 0 | 4 2 6 | 4 10 0 | 4 2 6 | 4 14 2 | 4 2 6 |
| Muriate of Potash (on basis of 80 per cent. purity) | Pot. 50 | 6 17 6 | 6 10 0 | 6 17 6 | 6 10 0 | 7 5 10 | 6 10 0 |
| Sulphate of Potash (on basis of 90 per cent. purity) | Pot. 48·6 | 7 17 6 | 7 10 0 | 7 17 6 | 7 10 0 | 8 10 10 | 7 10 0 |
| Steamed Bone Flour | N. 0·8<br>P.A. 28 | 6 5 0 | .. | 6 5 0 | .. | 6 5 0 | .. |
| „ „ „ | N. 0.8<br>P.A. 30 | .. | 5 15 0 | .. | 5 15 0 | .. | 5 15 0 |
| Bone Meal (Indian) | N. 4<br>P.A. 20 | 6 15 0 | 6 10 0 | 6 15 0 | 6 10 0 | 6 15 0 | 6 12 6 |
| Basic Slag ‡ .. | P.A. 12 | 2 5 0 | .. | 2 5 0 | .. | 2 5 0 | .. |
| „ „ .. | „ 13 | 2 7 0 | 1 5 6 | 2 7 0 | 1 5 6 | 2 7 0 | 1 5 6 |
| „ „ .. | „ 14 | 2 9 0 | 1 7 6 | 2 9 0 | 1 7 6 | 2 9 0 | 1 7 6 |
| „ „ .. | „ 15 | .. | 1 10 0 | .. | 1 10 0 | .. | 1 10 0 |
| „ „ (Foreign) ø | „ 15 | .. | 2 10 0 | .. | 2 10 0 | .. | 2 10 0 |

Abbreviations:—N. = Nitrogen; P.A. = Phosphoric Acid; Pot. = Potash.

* Carriage paid, in 6-ton lots. † Carriage paid, in 4-ton lots.

§ Fine grist, 90 per cent fineness through prescribed sieve.

‡ Basic Slag:—At Glasgow—80 per cent citric soluble and 80 per cent fineness; F.o.r., in 6-ton lots. At Leith—80 per cent citric soluble and 80 per cent fineness. On rail at Middlesboro'; carriage paid to Border stations 13s. to 15s. extra, and to Lothian stations 16s. to 17s. extra.

ø Ex-store, Leith: 2s. 6d. per ton less if lifted at quay.

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# INDEX TO VOL. XVIII—1935

PAGE

Adams, Professor W. G. S.: Better living: the community movement in the countryside 6

Agricultural administration in Scotland during the present reign 107

Agricultural colleges, notes from 64, 180, 366

Agricultural conditions 80, 187, 291, 394

Agricultural returns and statistics:
- Abstract of agricultural returns, 1934 78, 101
- Acreage under each variety of potatoes, 1935 75
- Agricultural returns, 1935 390
- Estimates of the produce of crops, 1934 84
- Prices of dead meat 95, 202, 303, 401
- Prices of eggs 96, 203, 304, 402
- Prices of fat stock 93, 200, 301, 399
- Prices of feeding stuffs 99, 206, 307, 405
- Prices of fertilisers 100, 207, 308, 406
- Prices of fruit and vegetables 97, 204, 305, 403
- Prices of potatoes 98, 205, 306, 404
- Prices of provisions 96, 203, 304, 402
- Prices of roots, hay, straw, moss litter 98, 205, 306, 404
- Prices of store stock 94, 201, 302, 400

Animal breeding:
- Analysis of growth and carcase measurement of baconers (*South Africa*) 193
- Attack on the gene (*U.S.A.*) 195
- Attempted improvement of the Blackface sheep in Zetland 342
- Congenital defects in the mammae of swine (*U.S.A.*) 194
- Disease-resistant cattle (*Gold Coast*) 91
- Genetics of the Hereford pattern (*U.S.A.*) 191
- Highly inbred herd of pedigree Shorthorn cattle (*U.S.A.*) 90
- Horn inheritance in sheep (*U.S.A.*) 193
- Inbreeding Berkshire swine (*U.S.A.*) 194
- Progeny test and individual performance as indicators of an animal's breeding value 296
- Reproduction in the sheep (*U.S.A.*) 192
- Riggs in pigs (*U.S.A.*) 91
- Semi-hairlessness in cattle (*U.S.A.*) 192
- Susceptibility to acute mastitis in cattle (*U.S.A.*) 191
- Technique for obtaining spermatozoa 298

Animal nutrition:
- Charcoal, an important supplement in the ration of sows (*Germany*) 92
- Comparative effectiveness in the dairy ration of supplements of phosphorus 196
- Cottonseed meal for pigs (*U.S.A.*) 197
- Ensiled pulp, fresh and ensiled leaves, etc., as a feed for milk cows (*Holland*) 92
- Feeding fodder sugar and (dried beet) slices to horses (*Germany*) 92
- Feeding hay meal (*Germany*) 196
- Feeding value of artificially dried young grass (*U.S.A.*) 196

**Animal nutrition**—*continued.* PAGE
  Influence of feed on the Merino sheep (*South Africa*) 196
  Linseed meal for growing and fattening lambs (*U.S.A.*) 196
  Management of pigs 231
  Nitrogen metabolism of growing pigs fed on dried yeast, etc. (*Germany*) 196
  Nutritive value of pasture 298
  Pig conference, Aberdeen 273
  Pig-feeding experiment with potatoes and dried skimmed milk (*Switzerland*) 299
  Potato tops for feeding (*Germany*) 316
  Potatoes in pig feeding 197
  Recent pig-feeding experiments 317
  Rice cake and rice gluten meal in pig fattening (*Germany*) 92
  Skimmed milk and whey as feedstuffs (*U.S.A.*) 92

Austria:
  Decline in beef consumption 378
  Disposal of surplus milk 286
  Emery flavour in milk 191

Belgium:
  Milk consumption propaganda 377

Better living: the community movement in the countryside 6

Blissett, A. H., B.Sc.: Recent pig-feeding experiments 317

Blow-fly attack in sheep, some observations on the prevention of 226

Bracken, eradication of, by cutting 121

Braid, K. W., M.A., B.Sc.: The eradication of bracken by cutting 121

Canada:
  Observations on the brown heart disease of turnips 295

Cattle situation in Scotland, notes on the 167

Cochrane, James, N.D.A.: The management of pigs 231

Cohen, Ruth L., M.A., and Murray, K. A. H., M.A., Ph.D.: Wheat prices and the acreage of wheat in Great Britain 354

Crops and seeds:
  Blue colour in malting barley (*Sweden*) 294
  Effect on the growth of oats of copper sprays (*U.S.A.*) 86
  Effect of various smut treatments on the yield of winter wheat (*U.S.A.*) 189
  Management of hill pastures 148
  Management of temporary pasture 140
  Mechanical treatment of rough hill pasture 159
  New developments in the heating of glass-houses 184
  Oat breeding in Scotland 86
  Observations on the brown heart disease of turnips (*Canada*) 295
  Pasture management (*New Zealand*) 189
  Percentage and viability of weed seeds recovered in the faeces of farm animals (*U.S.A.*) 294
  Plant pathology notes 164
  Raan or boron deficiency in swedes 326
  Report of the technical wheat committee (*Holland*) 190
  Seed yields of pedigree and commercial strains 190
  Some effects of lime on ryegrass 349
  Some factors influencing the standing power of oats 34
  Special sulphur dust *versus* lime sulphur for apple scab control 254
  Stem eelworm disease of oats and its control 47

Crops and Seeds—*continued.* PAGE
Toxicity of air containing sulphur dioxide gas (*U.S.A.*) . . . . . 295
Transition from woodland and moorland to grassland in the Spey valley . 296
Trials with strains of cocksfoot . . . . . . . . . . . 86

Dairying :
Comparison of lactation and yearly records of dairy cattle . . . . . 297
Control of milk and milk products in various countries . . . 286, 377
Emery flavour in milk (*Austria*) . . . . . . . . . . 191
Fat rising in cream . . . . . . . . . . . . . 88
Frequency of milking as affecting milk and butter-fat yields of Jersey cows . 298
Individuality of the mammary glands of the udder of the dairy cow (*U.S.A.*) 87
Milk Act 1934 (Section 9) Tuberculosis (Attested Herds) Scheme . . . 185
Milk marketing in Denmark . . . . . . . . . . . 20
Milking-machines in Scotland . . . . . . . . . . . 363
Nutritional aspects of milk pasteurisation (*U.S.A.*) . . . . . . 88
Proteins, minerals and vitamins of evaporated milk (*U.S.A.*) . . . . 88
Udder infections and sore throat illness . . . . . . . . 191
Virgin heifers secrete milk after injection (*U.S.A.*) . . . . . . 297

Denham, H. J., M.A., D.Sc.: Some trends in mechanised farming . . . 14

Denmark :
Milk marketing . . . . . . . . . . . . . . 20
Small-holdings . . . . . . . . . . . . . . 249

Dennis, R. W. G., Ph.D., and O'Brien, D. G., Ph.D.: Raan or boron deficiency in swedes . . . . . . . . . . . . . . . 326

Donald, George, B.Sc.: Some factors influencing the standing power of oats. . 34

Dunbar, J. S.: Small-holdings in Denmark . . . . . . . . . 249

Economics :
Aspects of agricultural reconstruction : a symposium . . . . . . 300
British sugar beet : ten years' progress under the subsidy . . . . . 88
Changes in permanent equipment of South Devon farms . . . . . 199
Economic survey of agriculture in the eastern counties of England . . 90
Economic survey of the poultry industry . . . . . . . . 89
Economic value of poultry on the farm . . . . . . . . . 300
Financial results on certain Devon and Cornish farms . . . . . . 198
Journal of the Agricultural Economics Society . . . . . . . 299
Planning of Britain's imports : a quantitative study of the effects of recent legislation . . . . . . . . . . . . . . . 89
Prize essays in agricultural economics . . . . . . . . . 388
Profitableness of farming in Scotland, Fourth Report . . . . . . 72
Recent land tenure changes in South Devon . . . . . . . . 199
Sociological background of adult education in rural districts. . . . . 199
Some aspects of small-holdings in the agricultural structure . . . . . 198
Wheat prices and the acreage of wheat in Great Britain . . . . . 354

Estate management as affected by recent agricultural depression. . . . . 309

Findlay, W. M., N.D.A.: The management of temporary pasture . . . . 140

Food control in various countries . . . . . . . . . . 286, 373

France :
Control of meat marketing . . . . . . . . . . . . 373
Control of milk and milk products . . . . . . . . . . 286

Germany :
Charcoal, an important supplement in the ration of sows . . . . . 92
Competition amongst hemp, flax and oat plants . . . . . . . 190
Control of egg marketing . . . . . . . . . . . . 288
Control of food prices . . . . . . . . . . . . . 289
Feeding of fodder sugar and (dried beet) slices to horses . . . . . 92

Germany—*continued.* PAGE
Feeding hay meal . . . . . . . . . . . . . . 196
Food prices and wages . . . . . . . . . . . 376
Growing self-sufficiency in food . . . . . . . . . 374
Importance of a suitable nutrient ratio for plants . . . . . . 296
Influence of artificial fertilisers and of farmyard manure on the fertility of the soil . . . . . . . . . . . . . . . . . 296
Influence of different dressings of nitrogen on the yield and composition of oats . . . . . . . . . . . . . . . . . 87
Influence of potash manuring on the chemical composition of crops . . . 191
Influence of manuring on the permeability of the soil . . . . . . 296
Nitrogen metabolism of growing pigs fed dried yeast, etc. . . . . . 196
Potato tops for feeding . . . . . . . . . . . . 196
Rice cake and rice gluten meal in pig fattening . . . . . . . 92
Skimmed milk in the ration of laying hens . . . . . . . . 92

Hall, John W., N.D.H.: Special sulphur dust *versus* lime sulphur for apple scab control . . . . . . . . . . . . . . . . 254

Heddle, R. G., M.A., B.Sc.:
The management of hill pastures . . . . . . . . . . 148
Mechanical treatment of rough hill pasture . . . . . . . . 159

Holland:
Control of milk and milk products . . . . . . . . . . 287
Ensiled pulp, fresh and ensiled leaves, etc., as a feed for milk cows . . . 92
Report of the technical wheat committee . . . . . . . . 190

Importation of Irish cattle into Great Britain, some eighteenth-century opinions on 236

Insects and pests:
Musk rats in Scotland . . . . . . . . . . . . . 175
Ox warble flies . . . . . . . . . . . . . . . 209
Some observations on the prevention of blow-fly attack in sheep . . . . 226

International Institute of Agriculture:
General assembly . . . . . . . . . . . . . . 70
Publications . . . . . . . . . . . . . . . . 290

International Congress for scientific management . . . . . . . 186

Italy:
Disposal of surplus milk . . . . . . . . . . . . . 286
Effect of artificial light on winter egg production . . . . . . 299
Fattening young cockerels . . . . . . . . . . . . 299

Kames, Lord—a great agricultural improver . . . . . . . . 334

Labour, management of . . . . . . . . . . . . . . 124

Labour on Scottish farms . . . . . . . . . . . . . . 75

M'Arthur, Margaret M., M.A., LL.B.: Some eighteenth-century Scottish opinions on the importation of Irish cattle . . . . . . . . . . 236

M'Callum, Alex., O.B.E., M.A., LL.B.:
A great agricultural improver—Lord Kames . . . . . . . . 334
The society of improvers . . . . . . . . . . . . . 40

M'Clymont, R. G., M.A., B.Sc., and Stewart, A., M.A., B.S.A.: Notes on the cattle situation in Scotland . . . . . . . . . . . . 167

Macdonald, J. A., B.Sc.: Plant pathology notes . . . . . . . . 164

PAGE

MacDougall, R. Stewart, M.A., D.Sc., LL.D.: Ox warble flies . . . . . 209

M'Dowall, R. K., Dip.R.T.C., A.M.Inst. C.E.: Potato blight . . . . . 243

M'Intosh, T. P., Ph.D., B.Sc.:
  Condition of potato consignments . . . . . . . . . . . 260
  Identification of potato varieties by chemical tests . . . . . . . 173

Macleod, A., B.Sc., and Ogg, W. G., M.A., B.Sc., Ph.D.: Reclamation and cultivation of peat land in Lewis . . . . . . . . . . . 153

Machinery, farm:
  The combine-harvester in East Lothian . . . . . . . . . 218
  The "gyrotiller" in Scotland . . . . . . . . . . . 52
  Relative economy of tractor and horse power in Western Canada . . . 266

Making roads to nowhere . . . . . . . . . . . . . 1

Miller, Wm. C.: Some observations on the prevention of blow-fly attack in sheep 226

Murray, K. A. H., M.A., Ph.D., and Cohen, Ruth L., M.A.: Wheat prices and the acreage of wheat in Great Britain . . . . . . . . . . 354

Musk rats in Scotland . . . . . . . . . . . . . . 175

New Zealand:
  Barley for poultry feeding . . . . . . . . . . . 198
  Pasture management . . . . . . . . . . . . 189

Nisbet, Alex. F. R., M.A., Ph.D.: Some effects of lime on ryegrass . . . 349

O'Brien, D. G., Ph.D., and Dennis, R. W. G., Ph.D.: Raan or boron deficiency in swedes . . . . . . . . . . . . . . . . 326

Ogg, W. G., M.A., B.Sc., Ph.D., and Macleod, A., B.Sc.: Reclamation and cultivation of peat land in Lewis . . . . . . . . . . 153

Orwin, C. S., M.A.: The management of labour . . . . . . . . 124

Overseas notes . . . . . . . . . . . . . . 286, 373

Ox warble flies . . . . . . . . . . . . . . . 209

Potatoes:
  Condition of potato consignments . . . . . . . . . . 260
  Identification of potato varieties by chemical tests . . . . . . 173
  Influence of manganese on different potato soil types . . . . . . 87
  Potato blight . . . . . . . . . . . . . . . 243
  Potato tops for feeding . . . . . . . . . . . . 196
  Potatoes in pig feeding . . . . . . . . . . . 197, 299
  Variability and correlation in the potato . . . . . . . . . 86

Poultry and eggs:
  Barley for poultry feeding (*New Zealand*) . . . . . . . . 198
  Control of egg marketing (*Germany*) . . . . . . . . . 288
  Effect of artificial light on winter egg production (*Italy*) . . . . . 299
  Effect of confinement brooding on growth and egg production (*U.S.A.*) . . 197
  Fattening young cockerels (*Italy*) . . . . . . . . . . 299
  Flightless fowls (*U.S.A.*) . . . . . . . . . . . . 195
  Ground oats as a substitute for wheat bran, etc., in rations for chicks (*U.S.A.*) 92
  Hopper- *versus* litter-feeding of grain (*U.S.A.*) . . . . . . . 299
  Inbreeding poultry . . . . . . . . . . . . . 194

Poultry and eggs—*continued.* PAGE
- Management of the laying hen on the general farm . . . . . . 131
- Reducing protein concentrates in rations of chicks (*U.S.A.*) . . . . . 197
- Relation of times of laying to hatchability (*U.S.A.*) . . . . . . 92
- Rye as feed for poultry (*U.S.A.*) . . . . . . . . . . 197
- Salt requirements of growing chicks (*U.S.A.*) . . . . . . . 198
- Skimmed milk in the rations of laying hens (*Germany*). . . . . . 92
- Wheat and wheat by-products for laying hens (*U.S.A.*) . . . . . 299

Reviews . . . . . . . . . . . . . . 74, 178, 275, 380

Robertson, D., Ph.D., B.Sc.(Agric.), N.D.A.: The stem eelworm disease of oats and its control . . . . . . . . . . . . . 47

Sandison, Ian E.: Attempted improvement of the Blackface sheep in Zetland . 342

Seed testing and plant registration station . . . . . . . . 57

Small-holdings in Denmark . . . . . . . . . . . . 249

Society of improvers . . . . . . . . . . . . . 40

Soils:
- Amphoteric nature of three coastal plain soils (*U.S.A.*) . . . . . 296
- Available phosphorus and potassium contents of soils (*U.S.A.*) . . . . 190
- Comparison of several legumes with respect to nitrogen accretion (*U.S.A.*) . 87
- Competition amongst hemp, flax and oat plants (*Germany*) . . . . . 190
- Crown rot of beet a boron deficiency . . . . . . . . . . 190
- Effect of application of sodium chlorate and ammonium thiocyanate on subsequent sowings of wheat (*U.S.A.*). . . . . . . . . . 87
- Importance of a suitable nutrient ratio for plants (*Germany*) . . . . 296
- Influence of artificial fertilisers and of farmyard manure on the fertility of the soil (*Germany*) . . . . . . . . . . . . . 296
- Influence of different dressings of nitrogen on the yield and composition of oats (*Germany*) . . . . . . . . . . . . . 87
- Influence of manganese on different potato soil types (*U.S.A.*) . . . . 87
- Influence of manuring in the permeability of the soil (*Germany*) . . . . 296
- Influence of soil treatment upon the composition of sweet clover (*U.S.A.*) . 87
- Reclamation and cultivation of peat land in Lewis . . . . . . . 153
- Response of chlorotic corn plants to the application of zinc sulphate (*U.S.A.*) 190
- Sensitivity of the potato plant to soil aeration (*U.S.A.*) . . . . . 296

South Africa:
- Analysis of growth and carcase measurement of baconers . . . . . 193

Statistics, guide to official . . . . . . . . . . . . 388

Stewart, A., M.A., B.S.A.: The relative economy of tractor and horse power in Western Canada . . . . . . . . . . . . . 266

Stewart, A., M.A., B.S.A., and M'Clymont, R. G., M.A., B.Sc.: Notes on the cattle situation in Scotland . . . . . . . . . . . 167

Street, A. G.: Making roads to nowhere . . . . . . . . . . 1

Sweden:
- Blue colour in malting barley . . . . . . . . . . . 294

Switzerland:
- Disposal of surplus milk . . . . . . . . . . . . 286
- Pig-feeding experiment with potatoes and dried skimmed milk . . . 299

United States: PAGE
- Amphoteric nature of three coastal plain soils . . . 296
- Attack on the gene . . . 195
- Available phosphorus and potassium contents of soils . . . 190
- Comparison of several legumes with respect to nitrogen accretion . . . 87
- Congenital defects in the mammae of swine . . . 194
- Cottonseed meal for pigs . . . 197
- Criticism of international wheat control . . . 378
- Effect of applications of sodium chlorate and ammonium thiocyanate on subsequent sowings of wheat . . . 87
- Effect of confinement brooding on growth and egg production . . . 197
- Effect on the growth of oats of copper sprays . . . 86
- Effect of various smut treatments on yield of winter wheat . . . 189
- Feeding value of artificially dried young grass . . . 196
- Flightless fowls . . . 195
- Genetics of the Hereford pattern . . . 191
- Ground oats as a substitute for wheat bran, etc., in rations for chicks . . . 92
- Highly inbred herd of pedigree Shorthorn cattle . . . 90
- Hopper- *versus* litter-feeding of grain . . . 299
- Horn inheritance in sheep . . . 193
- Inbreeding Berkshire swine . . . 194
- Individuality of the mammary glands of the udder of the dairy cow . . . 87
- Influence of manganese on different potato soil types . . . 87
- Linseed meal for growing and fattening lambs . . . 196
- Nutritional aspects of milk pasteurisation . . . 88
- Percentage and viability of weed seeds recovered in the faeces of farm animals 294
- Proteins, minerals and vitamins of evaporated milk . . . 88
- Reducing protein concentrates in rations of chicks . . . 197
- Relation of time of laying to hatchability . . . 92
- Reproduction in the sheep . . . 192
- Response of chlorotic corn plants to the application of zinc sulphate . . . 190
- Riggs in pigs . . . 91
- Rye as feed for poultry . . . 197
- Salt requirements of growing chicks . . . 198
- Semi-hairlessness in cattle . . . 192
- Skimmed milk and whey as feedstuffs . . . 92
- Susceptibility to acute mastitis in cattle . . . 191
- Toxicity of air containing sulphur dioxide gas . . . 295
- Virgin heifers secrete milk after injection . . . 297
- Wheat and wheat by-products for laying hens . . . 299

Wages:
- Farm wages in Scotland . . . 282
- Statistics of wages of agricultural workers in various countries . . . 199

Walker, L. M., B.Sc.:
- The combine-harvester in East Lothian . . . 218
- The "gyrotiller" in Scotland . . . 52

Wireless talks on agriculture . . . 389

Wright, D. P., Agric. Dip.: Management of the laying hen on the general farm . 131

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